Distr.
LIMITED

UNIDO/IS.341/Rev.2
5 February 1986

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

ENGLISH

DIRECTORY OF SOLAR RESEARCH INSTITUTES IN DEVELOPING COUNTRIES*

Prepared by

INTIB - THE INDUSTRIAL AND TECHNOLOGICAL INFORMATION BANK

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V.86-51318

INTRODUCTION

This is the second revision of a document originally published by UNIDO in 1982. The information contained in this document is based on questionnaires completed by institutes that had contributed previously as well as others that have become known to us in the meantime. Emphasis has again been given to indication by research institutes of areas in which they would like cooperation with similar institutes. The directory is thereby envisaged to promote international cooperation on solar research and commercialization of results of research. It is hoped that data provided in this directory will be used to promote contact and cooperation among institutions which may eventually lead to regional networks. UNIDO will be glad to assist in such networking efforts.

The information has been presented as provided by contributors on UNIDO's questionnaires circulated early in 1984 and during 1985. No standard terminology has been used regarding research activities except in the subject index preceding the data sheets where activities have been classified into accepted main categories of solar energy utilization. The questionnaires have also been fed into UNIDO's LINK data base for ease of updating the information as required.

We would like to thank those who have contributed to this directory and would welcome suggestions for improving it; corrections; or information on additional institutes who are interested in cooperative programmes in solar energy. It is intended to update this directory on a regular basis. A copy of the questionnaire is included at the back of this volume. For institutes not already contained herein this should be completed and returned to:

INTIB
UNIDO's Technology Programme
P.O. Box 300
A-1400 Vienna
Austria

SUBJECT INDEX

Area of solar research	Institutes
Active heating and cooling (space)	002, 006, 009, 023, 027, 029, 036, 039, 050, 051, 054, 055, 063, 064, 065, 067, 072, 073, 077, 081, 087, 092, 097, 109, 110
Collectors (flat plate and concentrating)	004, 007, 009, 010, 011, 027, 028, 029, 030, 036, 038, 041, 042, 047, 049, 062, 063, 073, 077, 078, 097, 102, 103, 107, 108
Desalination/Distillation	007, 009, 016, 022, 027, 028, 032, 033, 035, 045, 046, 049, 055, 056, 060, 064, 066, 067, 070, 071, 089, 098, 101, 102, 103, 107
Drying (crop, fish, timber etc.)	005, 006, 007, 009, 010, 011, 014, 016, 017, 018, 019, 022, 023, 026, 028, 033, 035, 038, 041, 044, 051, 055, 056, 057, 059, 060, 065, 066, 067, 070, 072, 073, 077, 078, 080, 089, 093, 096, 097, 098, 101, 102, 103, 107, 109, 114, 115
Greenhouse	005, 028, 047, 073
Industrial process heat	022, 027, 033, 038, 039, 110
Passive heating and cooling (space)	005, 007, 023, 028, 038, 039, 041, 046, 068, 070, 073, 078, 081, 086, 110
Photo-electrochemical conversion	029, 030, 031, 047
Photothermal conversion	002, 006, 009, 013, 029, 030, 034, 039, 053, 056, 073, 075, 092, 101, 102
Photovoltaic conversion (cells and systems)	001, 002, 004, 007, 008, 009, 013, 015, 021, 022, 025, 026, 027, 028, 030, 034, 042, 043, 044, 048, 050, 053, 054, 059, 060, 061, 073, 074, 075, 071, 081, 087, 088, 092, 095, 097, 099, 100, 102, 105, 106, 108, 111
Selective coatings	024, 028, 036, 056, 101, 102
Solar cooker	016, 019, 020, 022, 024, 026, 035, 037, 038, 070, 071, 089, 094, 095, 113, 115
Solar cooling and refrigeration	007, 009, 011, 015, 018, 022, 026, 027, 028, 029, 033, 035, 037, 048, 052, 056, 059, 062, 066, 072, 087, 097, 101, 102

Solar furnace	104
Solar materials	001, 028, 030, 031, 042, 069, 073, 076, 104, 111

Area of solar research	Institutes
Solar pond	027, 035, 041, 082, 087, 097
Solar radiation measurements	004, 007, 009, 012, 015, 017, 027, 044, 046, 050, 059, 062, 066, 072, 081, 082, 088, 092, 097, 102, 112, 113
Solar still	019, 055
Thermal storage	002, 009, 028, 049, 078, 102
Water heating	009, 010, 016, 022, 023, 026, 028, 033, 035, 036, 037, 038, 044, 049, 050, 051, 054, 056, 065, 066, 070, 071, 073, 075, 076, 077, 079, 082, 084, 089, 090, 103, 115
Water pumping (pv and thermal)	007, 009, 022, 027, 037, 043, 044, 052, 063, 084, 087, 103, 114

Related areas	
Biomass/biogas	006, 007, 009, 010, 011, 012, 013, 014, 015, 017, 019, 022, 026, 027, 029, 033, 034, 037, 041, 043, 048, 053, 055, 058, 060, 061, 073, 078, 079, 081, 083, 084, 085, 093, 094, 100, 102, 109, 115
Wind energy	007, 009, 010, 011, 012, 013, 015, 022, 026, 027, 029, 033, 034, 038, 045, 046, 049, 050, 053, 061, 064, 079, 082, 083, 084, 093, 099, 102, 108, 114
Mini-hydro	007, 010
Geothermal	006, 053
Hydrogen generation	022
Wood stoves	007, 012, 015, 019, 041
Energy conservation	005, 007, 023, 028, 031, 068, 077, 082, 085, 086, 091, 093, 110
Information and documentation	015, 040, 103

ALGERIA

001. CENTRE DE DEVELOPPEMENT DES MATERIAUX - LABORATOIRE DES MATERIAUX SOLAIRES

2, Bd. Frantz Fanon
BP 1017 Alger Gare
Algeria

Telephone: 61 14 18 Telex: 52 245
53 902

Director: A. Ould-Kaddour

Contact person: A. Ramdane, Chargé de Recherche

6 professional staff (5 PhD)

Government funded

Areas of research:

- Technology of single crystal silicon solar cells and of amorphous silicon solar cells
- Electrical, optical and structural characterization of these materials and cells
- Photovoltaic module encapsulation techniques
- Semiconductor detectors

Current projects:

- All areas as listed under 'Areas of research'

Joint research programmes carried out with:

- ENTE, Sidi-Bel-Abbes, Algeria

Suggested areas of co-operation with other research institutes:

- All areas as listed under 'Areas of research'

002. ENERGY CONVERSION DEVELOPMENT CENTER (C.D.C.E.)

2, Boulevard Frantz Fanon
BP 1017 Alger - Gare
Algeria

Telephone: 61 14 18 Telex: 53 902
52 245 NAWAT DZ

Director: Boualem Tatah

Contact person: A. Boudiaf, Research Scientist

5 professional staff (2 PhD)

Government funded

Areas of research:

- Photovoltaic solar energy conversion
- Solar distillation
- Solar thermal systems
- Energy storage
- Solar cooling systems
- Solar heating systems

Current projects:

- Experimental photovoltaic plant, the electrification of a village (= 100 KWp)
- Energy storage systems
- Solar cooling systems

003. STATION D'EXPERIMENTATION DES EQUIPEMENTS SOLAIRES

Route de l'observatoire
Bouzaréah
Alger
Algeria

Telephone: 78 42 29
79 12 08

Telex: 53 198 SEES

Director: Belhamel Maiouf

Contact person: Belhamel M., Director

100 professional staff (5 PhD)

Government funded

Areas of research:

- Photovoltaic solar energy
- Thermal solar energy
- Wind energy
- Geothermal energy
- Biomass

Current projects:

- Photovoltaic solar energy pumping
- Refrigeration
- Solar heating
- Desalination

Commercialized projects:

- Desalination
- Photovoltaic ground lighting
- Heating

Suggested areas of co-operation with other research institutes:

- Refrigeration
- Thermodynamic pumping
- Desalination

ARGENTINA

004. COMISION NACIONAL DE INVESTIGACIONES ESPACIALES (CNIE)
DEPARTAMENTO DE ENERGIAS NO CONVENCIONALES

Av. Mitre 3100
1663-San Miguel-Buenos Aires
Argentina

Telephone: 667-1272/2691/3044 664-1006/1209 Telex: LANBA AR 17511

Contact person: Ing. Alfredo Rapallini, Head of Department

12 professional staff

Government funded Annual budget 1984: US$ 150,000

Areas of research:

- Solar radiation measurements, installation and operation of a solar radiation network (50 stations)
- Solar collectors testing and modelling
- Photovoltaic systems

Current projects:

- Installation of a solar radiation network, presently 35 stations are in operation
- Photovoltaic systems (two pumping installations, one with 2 kWp and one with 4 kWp)

Commercialized projects:

Inflatable plastic air heating collectors for agricultural dryers have been developed and the technology transferred to a private company which is producing them

Joint research programmes carried out with:

- DFVLA, FRG, on the 2 kWp photovoltaic pumping project
- IILA, Italy, on the 4 kWp project

Suggested areas of co-operation with other research institutes:

In the above-mentioned areas with institutes in developing countries

005. GRUPO DE ENERGIA SOLAR - INSTITUTO DE FISICA ROSARIO
(CONICET-UNR/GES-IFIR)

Av. Pellegrini 250
2000 Rosario
Argentina

Telephone: (041) 63451 Telex: CIROS-AR 41817

Director: Dr. M. Castagnino

Contact person: Dr. R.D. Piacentini, Director, GES-IFIR

11 professional staff (2 PhD)

Government funded Annual budget 1984: US$ 15,000

Areas of research:

- Solar drying of agricultural products
- Greenhouses with efficient energy use
- Solar houses and buildings in humid and hot temperate climate
- Energy conservation in buildings

Current projects:

- Underground greenhouses with solar irradiation through lightduct
- Passive solar houses in humid and hot temperate climate
- Incidence of solar radiation in highly glassed buildings

Commercialized projects:

Solar bean with collectors of simple design

Joint research programmes carried out with:

- Laboratorio de Hidraulica, Saneamento e Meio-Ambiente
- Universidade Catolica do Parana, Rua Imaculada Conceicao, 115 - Prado Velho 80000, Curitiba, Brasil

Suggested areas of co-operation with other research institutes:

- Financial support for the exchange programme with Universidade do Parana (Brasil)
- Solar architecture
- Energy conservation

006. INSTITUTO DE INVESTIGACIONES EN ENERGIA NO CONVENCIONAL (INENCO)

Universidad Nacional
Buenos Aires 177
4400 Salta
Argentina

Telephone: 220500-145

Director: Mr. Luis R. Saravia

30 professional staff (7 PhD)

Government funded

Annual budget 1984: US$ 100,000 without salaries

Areas of research:

- Solar energy (thermal applications: housing, drying, minerals)
- Biomass (alcohol production)
- Geothermy

Current projects:

- Solar houses
- Solar drying of tobacco and red pepper
- Uses of solar ponds in mineral production
- Enzymatic conversion of cellulose

Commercialized projects:

- Solar houses
- Drying of red pepper
- Solar production of Na_2SO_4

Joint research programmes carried out with:

Several institutes, on national and international level

Suggested areas of co-operation with other research institutes:

As stated under 'Current' and 'Commercialized projects'

BARBADOS

007. CARIBBEAN DEVELOPMENT BANK/TECHNOLOGY AND ENERGY UNIT (CDB/TEU)

P.O. Box 408, Wildey
St. Michael, Barbados
West Indies

Telephone: (809) 426-1152 Telex: WB2287 Cable: CARIBANK

Contact person: Jeffrey Dellimore, Manager, Technology and Energy Unit

7 professional staff (1 PhD; 6 in-house consultants)

Funded by CDB and USAID Annual budget 1984: US$ 650,000

Areas of research:

- Solar crop drying
- Testing of solar collectors
- Desalination/distillation
- Passive cooling
- Solar radiation measurement
- Water pumping (photovoltaic)
- Photovoltaics
- Wind powered refrigeration
- Wind resource assessments
- Generation of electricity from wind (grid connected)
- Biomass - use of agricultural and industrial wastes
- Charcoal Production/cookstove design and testing
- Biogas
- Mini-hydro
- Energy conservation

Current projects:

A. More efficient use of oil
   - Hotel energy audits - Grenada
     Hotel Energy Conservation Manual
   - Energy efficient pilot ceramic tile project

B. Fuel Substitution
   - Bagasse for electricity generation (with ODA, CIDA AND CSC)
   - TEU passive solar building
   - Non-conventional water heating in tourism sector
   - Solar drying of chilli peppers
   - Testing of solar collectors
   - Wind turbine demonstration - Antigua
   - Integrated energy programme - Orange Hill, St. Vincent
   - Biogas from arrowroot bittie

- Monitoring and evaluation of TEU passive Solar Building
- Biogas at river plantation
- Wind-powered chill room - St. Lucia
- Electric power production from sawmilling wastes
- Grid-connected mini-hydro demonstration - Dominica
- Red Mud Plastic Bag Digester ($200m^3$)
- Wind Turbine Project - CDB
- UWI Solar Still Demonstration Project
- Pilot Biodigester at Wallilabou Factory - St.Vincent

C. Rural development and reducing recruitment of new fossil fuel consumers
- Banana transportation by aerial cableway
- Hydropower resources assessment - Dominica
- Promotion of simple domestic solar dryers
- Improving charcoal and fuelwood production and utilization

D. Preparation to meet future needs
- Peat resource assessment - Belize
- Wind and solar energy resource assessment
- Testing and demonstration of photovoltaic solar pumping system
- Biomass resource assessment
- Regional renewable energy development station - feasibility study
- Mineral resource assessment

E. Employment generation/utilization of indigenous resources
- Coir fibre pilot plan
- Chemical lime - Antigua
- Control of crop damage by monkeys
- Caribbean Appropriate Technology Centre - feasibility study
- Banana stem defibering pilot plant
- Feed and fertilizer from protein wastes
- Utilization of coconut wood
- Mechanical harvesting of arrowroot
- Assessment of arrowroot processing technology

Commercialized projects:

- Solar water heating standards - Barbados
- Drying of chilli peppers - Guyana
- Biodigestion of process wastes at Arrowroot Factory in St. Vincent

Joint research programmes carried out with:

CDB/TEU provides financing and supervises implementation of projects carried out by Institute of Applied Science and Technology, Georgetown, Guyana; Barbados National Standards Institution, St. Michael, Barbados; Caribbean Meteorological Institute, Bridgetown, Barbados; Caribbean Agricultural Research and Development Institute, St. John's, Antigua; Antigua Public Utility Authority, St. John's Antigua; German Appropriate Technology Exchange, Eschborn, FRG; Volunteers in Technical Assistance, Arlington, Va., USA; CARICOM Secretariat, Georgetown, Guyana.

Suggested areas of co-operation with other research institutes:

Sharing of technical information and results of pilot projects in other developing countries, especially small-scale industry, renewable energy and labour-saving devices for small farmers

BRAZIL

008. INSTITUTO DE FISICA - UNIVERSIDADE ESTADUAL DE CAMPINAS,
GROUPO DE ENERGIA

P.O. Box 6165, UNICAMP
13.100 Campinas, SP
Brazil

Telephone: (0162) 39 12 32 Telex: (019) 1150

Director: Prof. M. Zwanziger

Contact person: Prof. I. Chambouleyron, Head, Photovoltaic Programme

5 professional staff (PhD)

Government and private funded Annual budget 1984: US$ 100,000

Areas of research:

Photovoltaic cells and materials

Current projects:

- Polycrystalline silicon solar cells
- M-I-S and SIS solar cells
- Amorphous silicon solar cells

Suggested areas of co-operation with other research institutes:

Amorphous silicon solar cells

BURUNDI

009. CENTRE D'ETUDES BURUNDAIS EN ENERGIES ALTERNATIVES - CEBEA

B.P. 255
Bujumbura
Burundi

Telephone: 5710

Director: J-P. Trussart, Project Manager
Contact person: J-P. Trussart

5 professional staff

Government funded
+ technical assistance
from Belgium

Annual budget 1984: US$ 400,000

Areas of research:

- Active heating
- Refrigeration
- Collectors
- Distillation
- Domestic water heating
- Drying
- Photovoltaic conversion
- Solar radiation measurements
- Thermal conversion
- Thermal storage
- Water pumping
- Wind energy
- Gasifiers

Current projects:

As above

Joint research programmes carried out with:

- USAID (dryers and peat)
- European Community (gasifiers, thermal heating)
- University of Burundi
- Federal Republic of Germany (meteorology)
- CEPGL (Zaire - Rwanda - Burundi)
- UNESCO - ANSTI
- various ministries and research institutes in Belgium

010. CENTRE DE RECHERCHE DES UTILISATIONS DES ENERGIES ALTERNATIVES (CRUEA)

B.P. 2700,
Bujumbura
Burundi

Telephone: 55 56 **Telex: BDI 81**

Director: Dr. Joseph Katihabwa

Contact person: Dr. Joseph Katihabwa

6 professional staff (PhD)

Government funded **Annual budget 1984: US$ 1,500**

Areas of research:

- **Solar energy in general**
- **Biomass (biogas, gasification)**
- **Wind energy**
- **Hydro-power**

Current projects:

- **Solar collectors for crop drying and water heating**
- **Biogas and gasification**

Suggested areas of co-operation with other research institutes:

- **Solar energy**
- **Biomass**
- **Wind power**
- **Hydro-power**

CAMEROON

011. ECOLE NATIONALE SUPERIEURE POLYTECHNIQUE

B.P. 728,
Yaounde
Cameroon

Telephone: 23 12 26 Telex: UY 8384

Director: Mr. Henri Botta

Contact person: Mr. Ernest Kaptouom, Head of partment

6 professional staff (2 PhD)

Government and private funded Annual budget 1984: US$ 6,250

Areas of research:

- Solar absorption and refrigeration
- Design of a flat air-type collector and application for the drying of agricultural products

Current projects:

- Cold chain, particularly in the area of photovoltaic cold production for the preservation of medicines and perishable foods in rural areas

Commercialized projects:

Drying of agricultural products by means of a solar drier

Joint research programmes carried out with:

French energy research associations:
- Universite Claude Bernard, Lyon
- Fluid Thermodynamics Laboratory of the University of Paris, Sud Orsay
- Energy and Theoretical and Applied Mechanics Laboratory, INPL, Nancy
- GERDAT, Monpellier

Suggested areas of co-operation with other research institutes:

- Cold chains, particularly in the area of photovoltaic cold production for the preservation of medicines or perishable foods in rural areas
- Drying of agricultural products

012. **INSTITUTE FOR GEOLOGICAL AND MINING RESEARCH (IRGM), ENERGY RESEARCH LABORATORY (LRE)**

B.P. 4110
Yaounde
Cameroon

Telephone: 23 00 08

Director: Mr. Djallo Soba

Contact person: Mr. Augustin Simo, Chief, LRE

8 professional staff

Government funded Annual budget 1984: US$ 50,000

Areas of research:

- Solar Energy Applications
- Biomass
- Wind energy

Current projects:

- Solar radiation measurement
- Wind energy measurement
- Solar electrification of rural welfare centres
- Study of substrates for biogas production
- Woodstove

Suggested areas of co-operation with other research institutes:

- Biomass
- Bioenergy

EGYPT

013. DESERT DEVELOPMENT CENTER, THE AMERICAN UNIVERSITY IN CAIRO

113, Sharia Kasr El Aini
Cairo
Egypt

Telephone: 22 969-186 Telex: 92224 AUCAI UN Cable: Victorious Cairo

Director: Dr. Adli Bishay

Contact person: Dr. Adli Bishay

33 professional staff (15 PhD)

Government and private funded Annual budget 1984: US$ 1,500,000

Areas of research:

- Applications of renewable energy for desert development
- Solar thermal and photovoltaic
- Wind/electrical and mechanical
- Biogas
- Hybrid systems

Current projects:

Applications of renewable energy for desert development sponsored by USAID through Egyptian Supreme Council of Universities (Mini & Maxi University Linkages Projects).

Joint research programmes carried out with:

- University of Alexandria, Alexandria, Egypt
- University of Arizona, Tucson, Arizona, USA
- Wye College, London University, England

Suggested areas of co-operation with other research institutes:

Desert Development

ETHIOPIA

014. SCIENCE AND TECHNOLOGY UNIT (SIT/WRD),
UNITED NATIONS ECONOMIC COMMISSION FOR AFRICA (UNECA),

P.O. Box 3001
Addis Ababa
Ethiopia

Telephone: 44 72 00-215 Telex: 21029 Cable: UNECA ET

Director: Prof. A Adedeji, Executive Secretary, UNECA

Contact person: Prof. S. Jugessur, Chief, Science and Technology Unit

2 professional staff

United Nations funded Annual budget 1984: US$ 633,300

Areas of research:

- Solar drying of marine products
- Biogas generation

Current projects:

As above

Joint research programmes carried out with:

African Regional Centre for Technology, B.P. 2435, Dakar, Senegal

Suggested areas of co-operation with other research institutes:

- Solar drying in general
- Biogas generation

FIJI

015. ENERGY STUDIES UNIT (ESU), INSTITUTE FOR NATURAL RESOURCES

University of the South Pacific
Suva
Fiji

Telephone: 313900 Telex: FJ2276 Cable: UNIVERSITY SUVA

Director: Dr. John Morrison

Contact person: Dr. Bob Lloyd, Project Manager

4 professional staff

Funded by Government and AID Annual budget 1984: US$ 50,000

Areas of research:

- Solar radiation measurement
- Photovoltaic conversion
- Solar Refrigeration
- Energy surveys
- Energy audits
- Wind monitoring - small windmill assessment
- Wood stove testing
- Wood gasification

Current projects:

- Solar refrigeration
- Wind monitoring programme (Coom Islands)
- Wood gasification
- Wood stove testing
- Light efficiency testing

Joint research programmes carried out with:

- UN Pacific Energy Programme,
  Private BAG, Suva

Suggested areas of co-operation with other research institutes:

As above

GHANA

016. DEPARTMENT OF MECHANICAL ENGINEERING,
UNIVERSITY OF SCIENCE AND TECHNOLOGY

Kumasi
Ghana

Cable: KUMASITECH
GHANA

Director: Dr. V.K.A. Kpodo, Head of Department

Contact person: Dr. V.K.A. Kpodo

3 professional staff (1 PhD)

Government funded Annual budget 1984: US$ 50,000

Areas of research:

Harnessing and applications of solar energy

Current projects:

- Solar cookers
- Solar water heaters
- Solar crop dryers
- Solar distillation
- Evaporative coolers

Joint research programmes carried out with:

GTZ of the Federal Republic of Germany

Suggested areas of co-operation with other research institutes:

- Solar pumps for water supply and
Irrigation applications

017. DEPARTMENT OF PHYSICS, UNIVERSITY OF GHANA, LEGON

P.O. Box 63
Legon
Ghana

Telephone: 75381 Cable: University, Legon

Director: Dr. E.K. Agyei

Contact person: Dr. R.D. Baeta, Senior Lecturer

3 professional staff

Government funded Annual budget 1984: US$ 25,000

Areas of research:

- Solar insolation
- Crop drying
- Biomass

Current projects:

Solar insolation studies of the sub-region (collaborative work)

Joint research programmes carried out with:

- Laboratoire sur L'Energie Solaire, Universite du Benin, B.P. 1515, Lome, Togo (Dr. M. Gniniivi)
- E.A.S.T., Universite Nationale du Benin, Cotonou, Republic Populaire du Benin (Dr. T. Bondu-Zin)

Suggested areas of co-operation with other research institutes:

- Crop drying
- Biomass
- Photovoltaics

018. INDUSTRIAL RESEARCH INSTITUTE

P.O. Box M.32
Accra
Ghana

Telephone: 75202/77758 Telex: SCIENCES

Director: Ms. A. Amoako-Mensah

Contact person: Dr. M.F. Damptey, Engineering Consultant

30 professional staff (4 PhD)

Government funded Annual budget 1984: US$ 905,593.45

Areas of research:

- Solar dryer: for farm produce (cassava, pepper ground nuts etc.)
- Solar cooler: for preserving perishables (meat, fish, vegetables, cold water for rural people etc.)

Current projects:

Solar dryer: extension service for cocoa beans for the benefit of cocoa farmers (about to start)

Commercialized projects:

Information on solar dryer to women in development is being applied in small-scale cassava flour (Konkonte) factory

Joint research programmes carried out with:

Food Research Institute (CSIR) Ghana

Suggested areas of co-operation with other research institutes:

- Solar electric generators
- Solar cookers

INDIA

019. AGRICULTURAL TOOLS RESEARCH CENTRE (ATRC)

Suruchi Campus
Post Box 4
Bardoli 394601
India

Telephone: 95, 258

Director: Mr. Mohan Parikh

Contact person: Mr. Rahul Parikh, Research Engineer

2 professional staff

Private funded Annual budget 1984: US$ 3,000

Areas of research:

- Solar cooker - box type
- Solar still
- Solar dryer
- Biogas manure plants
- Wood burning stoves

Current projects:

- Design of low-cost and reliable fixed dome biogas manure plant
- Design of solar dryer for food drying and cattle meat drying

Commercialized projects:

- Solar cookers - about 1000 marketed
- Solar stills - 5 marketed
- Biogas plants - ATRC design adopted by a few thousand farmers

Suggested areas of co-operation with other research institutes:

- Solar distillation
- Solar drying
- Wood burning stoves

020. APPROPRIATE TECHNOLOGY DEVELOPMENT ASSOCIATION (ATDA)

P.O. Box 311
Gandhi Bhawan
Lucknow 226001 (U.P.)
India

Telephone: 33 506 Cable: APTECH

Director: Mr. M.M. Hoda, Director-cum-Secretary General

Contact person: Mr. M.M. Hoda

28 professional staff
Government and private funded Annual budget 1984: US$ 700,000

Areas of research:

- Rural planning
- Agriculture
- Animal husbandry
- Health and Sanitation
- Energy
- Housing and construction
- Cottage and rural industries
- Water supply

Current projects:

- Wool spinning
- Cotton spinning
- Agricultural tools
- Mini cement
- Mini sugar
- Solar cooker
- Water mill
- Dairying
- Hydraulic ram

Commercialized projects:

Mini sugar

Joint research programmes carried out with:

- Bremen Overseas Research and Development Association (BORDA), FRG
- Khadi & Village Industries Commission (KVIC), Bombay, India
- U.P. Gandhi Smarak Nidhi, Lucknow, India
- Intermediate Technology Development Group (ITDG) London, UK
- I.T./I.S, Rugby, UK

021. BHARAT HEAVY ELECTRICALS LIMITED, CONTROL EQUIPMENT DIVISION

P.O. Box 2606
Mysore Road
Bangalore - 560 026
India

Telephone: 60 30 24 Telex: 0845-436 Cable: BHARATELEC

Director: Mr. M.S.S. Murthy, General Manager

Contact person: Mr. E.S. Ramamurthy, Dy. General Manager

30 professional staff (4 PhD)

Government funded — No separate allocation, included in original R+D budget

Areas of research:

- Alternate low cost processing techniques for single crystal solar cells
- Improvements in solar cells for space applications
- Use of polycristalline silicon in solar cell processing line
- Amorphous silicon technology

Current projects:

- Optimization of AR coating for specific types of texturized surfaces
- Compatibility of polycristalline silicon wafers with specific processing techniques used in single crystal line
- Screen printed solar cells
- Design and installation of 100 kW photovoltaic power station

Suggested areas of co-operation with other research institutes:

- All areas of solar cell manufacture, both for terrestrial and space applications
- System engineering and evaluation of medium and large sized photovoltaic power stations

022. CENTRAL ARID ZONE RESEARCH INSTITUTE

Jodhpur
India

Telephone: 23986
21865

Cable: ARIDZONE

Director: Dr. K.A. Shankarnarayan

Contact person: Dr. Jagdish P. Gupta, Head, Division of Wind Power and Solar Energy Utilization and Principal Investigator and Co-ordinator (Solar Energy)

7 professional staff (3 PhD)

Government funded

Annual budget 1985: US$ 1,000,000

Areas of research:

- Solar energy for water heating, cooking, drying, distillation/desalination, process heat for industries, brine evaporation, water pumping, refrigeration, candle making, photovoltaic conversion, hydrogen generation, etc.
- Wind power for water pumping, electric generation
- Biogas for cooking, illumination

Current projects:

- Eco-energy use pattern and energy management
- Solar water heaters
- Solar cookers
- Solar desalination, distillation and electrodialysis
- Solar dryers
- Saline brine evaporation
- Caustic soda regeneration
- Solar thermal storage
- Solar collection from natural surfaces
- Multipurpose solar devices
- Solar cells
- Pulsed concentrated solar radiation for seed growth (Exploratory study)
- Zeolite for refrigeration (Exploratory study)
- Hydrogen energy systems (Exploratory study)
- Wind power for water pumping and battery charging
- Low cost biogas plants

Commercialized projects:

Know-how given to entrepreneurs for commercialization of natural circulation type solar water heaters and solar cookers (oven and box type) and to railways for multistepped basin solar stills.

Joint research programmes carried out with:

The Institute co-ordinates the activities on solar energy at Central Institute of Agricultural Engineering, Bhopal, Central Rice Sukhadia University, Udaipur and Tamil Nadu Agricultural University, Coimbatore under an All India Co-ordinated Research Project for Renewable Energy Sources for Agriculture and Agrobased Industries.

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research' and 'Current projects' and also on wood burning cook stoves.

023. CENTRAL BUILDING RESEARCH INSTITUTE (CBRI)

Roorkee (U.P.)
India

Telephone: 2243, 2608, 2281, 2269 Telex: 0597/203 Cable: BILDSERCH ROORKEE

Director: Dr. Shamsher Prakash

Contact person: Mr. A.C. Banerjee, scientist (information)

174 professional staff (38 PhD)

Government funded

Areas of research:

- Building materials
- Foundation engineering
- Civil engineering
- Building economics and management
- Rural housing and environment
- Building physics
- Solar energy
- Architecture and physical planning
- Biogas technology
- Fire research

Current projects:

- Development of evaporation and moveable insulation passive system for cooling of buildings
- Study of energy conservation measures for cold storage
- Energy responsive design of buildings and human settlements based on non-conventional sources of energy

Commercialized projects:

- Solar water heater (domestic and industrial model)
- Solar timber seasoning kiln
- Low-cost pipe type solar water heater

Suggested areas of co-operation with other research institutes:

Solar heating and cooling

024. CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE (CECRI)

Karaikudi - 623 006
India

Telephone: 368 Telex: 04 55-285

Director: Dr. K.S. Rajagopalan

Contact person: Mr. S. John, Scientist

4 professional staff

Government funded Annual budget 1984: US$ 7,000

Areas of research:

- Solar absorber coatings for flat plate collectors and concentrators
- Solar cooker

Current projects:

High temperature solar absorber coatings for concentrators

Suggested areas of co-operation with other research institutes:

Solar absorber coatings for flatplate collectors and concentrators

025. CENTRAL ELECTRONICS ENGINEERING RESEARCH INSTITUTE (CEERI)

SSD Division, CEERI
Pilani
Rajasthan - 333 031
India

Telephone: 192 Cable: ELECTRONIC

Director: Dr. Amarjeet Singh

Contact person: Dr. W.S. Khokle, Deputy Director

8 professional staff (2PhD)

Government funded Annual budget 1984: US$ 100,000

Areas of research:

- Photovoltaics
- Development of high efficiency solar cell for panel fabrication using concentrated sunlight

Current projects:

Development of high efficiency silicon and GaAs solar cells

Suggested areas of co-operation with other research institutes:

- Photovoltaics
- Silicon solar cells fabrication for concentrated sunlight (30-50x)

026. **CENTRAL INSTITUTE OF AGRICULTURAL ENGINEERING**

Additional A-Block, GTB Complex
T.T. Nagar
Bhopal - 462 003 (M.P.)
India

Telephone: 63 618, 62 756, 62 598, 75 616, 75 141, 75 088, 74 535
Telex: 0705-273
Cable: KRIYANTRA

Director: Dr. T.P. Ojha

Contact person: Dr. R.C. Maheshwari, Head, E.M.E. Division

38 professional staff (11 PhD)

Government funded

Annual budget 1984: US$ 1,000,000

Areas of research:

- Research and development of tools, implements and machinery for agricultural production
- Post harvest technology and sources of energy and power for agriculture and rural sector

Current projects (under the energy research programme):

- Solar cooking
- Solar water heating
- Solar photovoltaic pump
- Crop drying
- Solar irrigation
- Solar refrigeration
- Wind energy
- Biogas

Joint research programmes carried out with:

- International Crop Research Inst. of Semi Arid, Hyderabad, India
- International Rice Research Institute, Philippines
- Regional Network for Agricultural Machinery, c/o UNDP Philippines
- National Institute of Agricultural Engineering, Silsoe, UK

Suggested areas of co-operation with other research institutes:

- Solar greenhouse
- Solar crop drying
- Biomass energy conversion
- Biogas technology
- Wind energy utilization for irrigation

027. CENTRAL SALT AND MARINE CHEMICALS RESEARCH INSTITUTE (CSMCRI), BHAVNAGAR

Gijubhai Badheka Marg
Bhavnagar - 364 002
Gujarat
India

Telephone: 24496, 23960 Telex: 0162-230 Cable: NAMAK BHAVNAGAR

Director: Prof. M.M. Taqui Khan

Contact person: Dr. S.D. Gomkale, Scientist

14 professional staff (5 PhD)

Government (mainly) and private funded

Annual budget: US$ 60,000-80,000

Areas of research:

- Air conditioning and refrigeration
- Collectors
- Desalination/distillation
- Industrial process heat
- Photovoltaic conversion (applications)
- Solar pond
- Solar radiation measurements
- Water pumping
- Wind energy
- Biomass

Current projects:

- Deep solar pond for thermal energy and subsequently power generation
- Solar thermal applications like industrial heat, desalination and cooling
- Solar radiation measurements

Commercialized projects:

Installed demonstration plants for solar water and air heating in three textile mills

Joint research programmes carried out with:

- The Institute worked under UNIDO for setting of solar stills plant in Republic of Somalia (1978-1979);
- The Institute is planning to work with National Aeronautical Laboratory, Bangalore, on solar pond project;
- Work was completed on solar thermal pump in collaboration with Swiss Development Corporation.

Suggested areas of co-operation with other research institutes:

- Desalination
- Solar pond
- Solar cooling

028. CENTRE FOR ENERGY STUDIES, INDIAN INSTITUTE OF TECHNOLOGY, DELHI

Hauz Khas
New Delhi - 110 016
India

Telephone: 66 69 79-254
65 40 54

Cable: TECHNOLOGY DELHI

Director: Prof. N.M. Swani, Director, Indian Institute of Technology

Contact persons: Prof K.L. Chopra, Head, Centre for Energy Studies;
Prof. S.S. Mathur

27 professional staff

Government and private funded

Areas of research:

- Photovoltaic conversion
- Photovoltaic materials
- Selective coatings
- Low temperature applications of solar energy
- Solar water heating
- Solar drying
- Solar passive heating and cooling
- Solar desalination
- Solar refrigeration
- Greenhouses
- Thermal storage
- Linear solar concentrations
- Concentrators
- Plastic collectors
- Bioenergy
- Energy conservation

Current projects:

- Solar photovoltaics
- Water heating
- Solar drying
- Solar desalination
- Solar cookers
- Solar passive building
- Energy conservation

Joint research programmes carried out with:

- C.N.R.S., France
- International Potato Centre, Peru
- National Industrial Corporation Ltd., New Delhi
- with institutes worldwide, especially in FRG, France and Norway

Suggested areas of co-operation with other research institutes:

In spite of its co-operation programme with developed countries, the Institute is willing to co-operate with developing countries. A United Nations University sponsored programme is already under progress at the CES to train the scientists, technologists and policy makers of various developing countries. Specifically, the Institute would wish to co-operate in:

- Photovoltaic materials
- Selective coatings
- Low temperature applications of solar energy
- Linear solar concentration
- Solar architecture
- Solar refrigeration

029. INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY

Powai
Bombay - 400 076
India

Telephone: 58 14 21

Director: Prof. A.K. De

Contact person: Prof. S.P. Sukhatme, Deputy Director

10 professional staff

Government and private funded

Areas of research:

(a) Solar thermal applications
- Flat-plate collectors
- Concentrators
- Thermal power
- Refrigeration
- Space cooling

(b) Biomass gasification and biogas
- Use as fuels in automotive engines

(c) Wind energy
- Development of multiblade wind mill

(d) Electrochemical cell development

Current projects:

- Solar concentrator development
- Flat-plate collectors using unconventional materials

Commercialized projects:

- Solar refrigeration
- Biomass gasification

Suggested areas of co-operation with other research institutes:

Any of the above-mentioned areas

030. INDIAN INSTITUTE OF TECHNOLOGY (IIT), KHARAGPUR

Kharagpur 2 - 721302
(W.B.)
India

Director: Prof. G.S. Sanyal

Contact person: Dr. P. Pramanik, Assistant Professor

425 professional staff (400 PhD)
(including other sections)

Government funded

Annual budget 1984: US$ 8,000,000
(total budget IIT)

Areas of research:

- Solar collector
- Solar photovoltaics
- Solar electrochemical cell
- Development of solar energy materials
- Solar thermovoltaics

Current projects:

- Development of solar cell grade silicon
- Development of solar electrochemical cells

Joint research programmes carried out with:

Indian Association for Cultivation of Science, Calcutta 32

Suggested areas of co-operation with other research institutes:

- Solar furnace
- Solar photovoltaics
- Solar desalination plant

031. **INTERDISCIPLINARY RESEARCH GROUP (IDRG)**

Vikram Sarabhai Space Centre
Trivandrum - 695 022
India

Telephone: 56 38 58 Telex: 0884-201
-202

Director: Dr. V.R. Gowariker

Contact person: Mr. S.K. Nema, Member, IDRG

6 professional staff (5 PhD)

Government funded Annual budget 1984: US$ 50,000

Areas of research:

- Photocatalysis
- Photoelectrochemical solar energy conversion systems
- Synthetic membrane development for solar energy conversion systems

Current projects:

- Photochemical hydrogen generation using perfluoromembrane modified cadmium sulfide semiconductor
- Photochemical diode membrane - synthesis, characterization and evaluation

Suggested areas of co-operation with other research institutes:

Photoelectrochemical and photoassisted water splitting (i.e. hydrogen generation) and systems development thereof

032. JAWAHARLAL NEHRU UNIVERSITY (JNU), UNIVERSITY INSTRUMENTATION CENTRE

Computer Centre Building
New Delhi - 110067
India

Telephone: 65 22 82-337(0)
-299(R)
Cable: USIC/JAYENU

Director: Prof. P.N. Srivastava, Vice Chancellor

Contact person: Dr. G.C. Pandey

Government and private funded

Areas of research:

(a) Solar energy
- Solar water desalination/distillation
- Integrated use of solar appliances
- socio-economic study

(b) Energy and environment
- Application of solar/waste thermal (industrial) energy in water pollution control

Current projects:

(a) Instrumentation
- Development of methods for pollution control
- Photo-acoustic spectroscopy

(b) Studies on material for metal pollution control in aqueous systems

Commercialized projects:

Absorption of solar radiations by water: work on dyes has already been tested on large solar stills

Joint research programmes carried out with:

Not in the field of solar energy

Suggested areas of co-operation with other research institutes:

- Solar water distillation/desalination
- Studies on photo-electrochemical cells with special reference to their utilization in solar still
- Energy and environment

033. JYOTI LIMITED, ENERGY DIVISION

Tandalja
Vadodara - 391 410
India

Telephone: 59 518, 59 618 Telex: 01775-370 SUN-IN Cable: JYOTIPUMPS

Contact person: Dr. B.C. Jain, General Manager

30 professional staff (6)

Private funded Annual budget 1984: US$ 200,000

Areas of research:

- Solar hot water systems
- Solar hot air systems
- Solar steam generation systems
- Solar desalination systems
- Solar/biomass powered refrigeration systems
- Biomass gasification systems
- Wind electric conversion systems
- Waste heat recovery equipments

Current projects:

(a) - Solar cabinet dryer
- Solar wood seasoning kiln
- Open tank thermosyphon solar systems
- 100 kW wood gasifier engine system
- 1 kW wind electric conversion system

(b) - Solar hot water systems for various applications totalling nearly 10,000m^2 of collector area
- Solar hot air systems for textile industry and for artificial marble manufacturing company
- 350W wind electric conversion system for irrigation and village lighting applications
- Solar powered cold storages of 10 TR and 30 TR capacity
- Absorption refrigeration system based on waste vapours for chemical industry

Suggested areas of co-operation with other research institutes:

- Industrial hot water/hot air systems
- Biomass gasification systems

034. KAPUR SOLAR FARMS

Bijwasan Najafgarh Road
P.O. Kapas Hera
New Delhi - 110037
India

Telephone: 391 747, 39 19 36 Telex: 2132

Director: Mr. Jagdish Chandra Kapur

Contact person: Mr. Jagdish Chandra Kapur

5 professional staff

Private funded Annual budget 1984: US$ 50,000

Areas of research:

Integrated energy systems for the satisfaction of variety of energy needs of rural communities in an optimal manner incorporating solar thermal, photovoltaics, wind, biogas generation, using a variety of animal, plant and human wastes.

Current projects:

- Related experiments using energy drawn from the integrated system for heating, refrigeration, cooking and other applications
- Application of research to three villages now under planning

Joint research programmes carried out with:

M/s. Danfoss India Ltd., New Delhi

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research' and 'Current projects'

035. **MECHANICAL AND INDUSTRIAL ENGINEERING DEPARTMENT, UNIVERSITY OF ROORKEE (MIED/UOR)**

Roorkee - 247667
India

Director: Dr. D.V. Singh, Professor and Head

Contact persons: Dr. C.P. Gupta, Professor; Dr. Rajendra Prakash, Professor

18 professional staff (in thermal sciences group; 12 PhD)

Government funded

Areas of research:

- Solar refrigeration
- Solar distillation
- Solar dryers
- Solar power generation
- Solar assistance in kitchen
- Solar water heating

Current projects:

- Solar refrigeration
- Solar drying
- Solar assistance for kitchen
- Solar water heating
- Solar ponds

Commercialized projects:

- Solar heating of a factory shed
- Solar assistance for kitchens

Suggested areas of co-operation with other research institutes:

Solar engineering in general (all spheres)

036. **RESEARCH AND DEVELOPMENT CENTRE, HINDUSTAN BROWN BOVERY LTD.**

P.O.Box 284
Vadodara 390 001
Gujarat
India

Telephone: 42 141 (5 lines) Telex: 212 Cable: HINDBOVERI

Director: Mr. M. Sahadevan

Contact person: Mr. R.S. Soin, Senior Engineer

25 professional staff (25)

Private funded Annual budget 1984: US$ 60,000

Areas of research:

- Solar water heating
- Solar air heating
- Solar concentrator
- Two phase transport
- Energy management
- Selective surfaces

Current projects:

- Solar water heater: flow distribution studies and methods of balancing
- Solar air heater: field trials and commercial models
- Solar concentrator
- Selective coating

Commercialized projects:

- Solar water heater and energy management: 250 lpd to 35,000 lpd or more at 60-70 centigrade
- Solar air heater: entering the commercial market

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research'

037. RESOURCES DEVELOPMENT INSTITUTE (RDI)

1100 Qrs. Area
Bhopal - 462 016
India

Telephone: 65361 Cable: RESOURCES DEVELOPMENT INSTITUTE

Director: Mr. G.G. Puri, Executive Director

Contact person: Mr. G.G. Puri

7 professional staff

Funded by subscriptions, donations, consultancy, project funding Annual budget 1984: US$ 50,000

Areas of research:

Energy technologies for the poor:
- Solar pumps through stirling engine
- Clay biogas plants
- Cheap solar cookers
- Water heaters
- Aqua Amonia
- Cold storage system
- Indoor solar cookers etc.

Current projects:

(a) Research - Technology Transfer-cum-Training Project for rural development
- Clay solar cookers
- Clay biogas plant
- Prefabricated burnt clay cheap houses and fuel efficient wood stove

(b)
- Solar pumps through modified stirling engines
- Indoor solar cookers
- Clay biogas plant

Commercialized projects:

First field application of research for the benefit of the rural poor just started under the Research Technology Transfer-cum-Training Project

Joint research programmes carried out with:

- National Physical Laboratory, New Delhi
- IIT. Bombay
- CSMCRI Bhavnagar

Suggested areas of co-operation with other research institutes:

- Biogas technology
- Solar technology

038. **SOLAR ENERGY GROUP, DEPARTMENT OF MECHANICAL ENGINEERING, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA**

Ludhiana - 141 004
India

Telephone: 22 960-224/222 Cable: AGRIVERSITI

Director: Prof. Dr. L.S. Cheema, Head, Dept. of Mechanical Engineering

Contact person: Dr. K.D. Mannan. Prof. of Mechanical Engineering

5 professional staff (2 PhD)

Government and private funded Budget 1983-1984: US$ 50,000

Areas of research:

- Solar water heaters
- Solar crop drying systems
- Steam generation systems
- Stationary concentrators both of symmetric and assymmetric configurations
- Solar cooking and solar cookers
- Passive environmental control of buildings
- Wind power systems

Current projects:

Three projects concerned with crop drying systems and wind power are currently being investigated:

- Field evaluation of developed solar technologies of solar cooking and water heating
- Natural environmental control of buildings and stationary solar concentrating systems
- Computer modelling of solar thermal systems

Joint research programmes carried out with:

The institute has what came to be known as 'co-ordinated research projects', which are simultaneously being investigated at other centres in the country. These projects are funded by the Indian Council of Agricultural Research.

Suggested areas of co-operation with other research institutes:

- Solar cooking
- Crop drying systems
- Water heating systems
- Passive environmental control of buildings
- Stationary concentrating systems for collecting solar energy up to 150 centigrade

039. THE NATIONAL INDUSTRIAL DEVELOPMENT CORPORATION LIMITED (NIDC)

Chanakya Bhavan
Africa Avenue
Chanakya Puri
New Delhi 110 021
India

Telephone: 670 153 Telex: 031-2871 NIDC Cable: NIDCORPON

Director: Dr. Ram K. Iyengar, Chairman-cum-Managing Director

Contact person: Dr. S.C. Bose, Chief Manager

300 professional staff (2 PhD)

Funded by Government and self-generation

Annual budget 1984: US$ 1,500,000

Areas of research:

- Solar thermal with special reference to hot air systems for industrial and continuous use
- Solar passive and active architecture

Current projects:

- Solar drying establishment for drying agricultural products
- Processing of tea, using predominantly renewable source of energy
- Drying of mill wet bagasse
- Curing of flue cured virginia tobacco

Suggested areas of co-operation with other research institutes:

As above

040. TATA ENERGY DOCUMENTATION AND INFORMATION CENTRE

TATA Energy Research Institute
24, Homi Mody Str.
Bombay 400 023
India

Telephone: 24 50 70

Director: Mr. N.K. Gopalakrishnan

Contact person: Mr. N.K. Gopalakrishnan

6 professional staff

Private funded Annual budget 1984: US$ 20,000

Areas of research:

- Solar energy information
- Indian energy documentation

Current projects:

- Information consolidation and new and renewable sources of energy: Cookstoves, biogas technology, windpumps

Joint research programmes carried out with:

UNESCO

Suggested areas of co-operation with other research institutes:

- Information dissemination
- Energy documentation

041. TATA ENERGY RESEARCH INSTITUTE, FIELD UNIT (TERI/FRU)

c/o Sri
Aurobindo Ashram
Pondicherry - 605002
INDIA

Telephone: 3483 Cable: AUROBINDO

Director: Dr. C.L. Gupta

Contact person: Ms. S. Gupta

3 professional staff

Private funded Annual budget 1984: US$ 50,000

Areas of research:

- Advanced flat plate collectors using CSD's
- Solar ponds
- PCM storage modules
- Convective drying systems
- Passive heating systems
- Biogas processes
- Biomass productivity
- Energy resources analysis
- Fuelwood cookstoves
- Eco-community

Current projects:

- PCM storage modules
- Biogas process and appliances
- Fuelwood cookstoves
- Integrated rural energy planning

Commercialized projects:

- Solar cookers
- Fuelwood cookstoves
- Integrated biogas plants
- Industrial water heating
- Solar drying systems

Joint research programmes carried out with:

- MCRC, Madras, on integrated rural planning
- Informally with many institutes abroad
- Represented on energy panels of Tamil Nadu and Andra Pradesh governments and Central Government

Suggested areas of co-operation with other research institutes:

- Co-operation depends on country and institute involved

042. TATA INSTITUTE OF FUNDAMENTAL RESEARCH (TIFR)

Homi Bhabha Road
Bombay - 400 005
India

Telephone: 21 91 11 Telex: 011-3009 TIFR IN Cable: ZETESIS

Director: Prof. B.V. Sreekantan

Contact person: Prof. G. Swarup, Senior Professor

8 professional staff (in solar energy research; 8 PhD)

Government funded

Annual budget 1984: US$ 150,000
(for solar energy research)

Areas of research:

(a) School of mathematics
- Algebra
- Algebraic geometry
- Algebraic groups
- Algebraic Topology
- Combinatories
- Differential equation
- Differential geometry
- Function theory
- Functional Analysis
- Lic groups and Lic algebra
- Number theory etc.

(b) School of physics
- Theoretical physics
- Astronomy and theoretical astrophysics
- Cosmic rays
- Gravitation and high energy physics
- Nuclear and atomic physics
- Hydrology
- Condensed matter and semiconductor
- Chemical physics
- Molecular biology
- Computer science and speech research

Current projects (in solar energy):

- Stretched tape fixed mirror solar concentrator
- Modified photo electrodes
- Biochemical fuel cells
- Amorphous semiconductors

INDONESIA

043. AGENCY FOR ASSESSMENT AND DEVELOPMENT OF TECHNOLOGY (ENERGY DEVELOPMENT AND APPLICATION PROJECT)

Jalan M.H. Thamrin 8
Jakarta
Indonesia

Telephone: 3042466 Telex: 44331-ATP-JKT

Director: Dr. L. Panggabean

Contact person: Dr. Abubakar Lubis, Project Leader

21 professional staff

Government funded Annual budget 1984: US$ 175,000

Areas of research:

- Solar cell technology
- Photovoltaic power plant
- Solar thermal pump
- Gasification power plant
- Biogas

Current projects:

As above

Commercialized projects:

Wood gasification, under preparation for manufacture

Joint research programmes carried out with:

TUV - Rheinland, Am Grauen Stein - 5000 Koeln 91, FRG

Suggested areas of co-operation with other research institutes:

In the above-mentioned fields and other alternative energy sources

044. LEMBAGA FISIKA NASIONAL (LFN-LIPI) - NATIONAL INSTITUTE FOR PHYSICS

Jl. Cisitu Kompleks LIPI
Bandung
Indonesia

Telephone: 022-81052/83050

Director: Mr. Arjuno Brojonegoro

Contact person: Mr. Iman Tarigan, Head of Technology Dev.

8 professional staff (PhD)

Government funded research contract

Annual budget 1984: US$ 600,000

Areas of research:

- Photovoltaic application (water pumping)
- Development of solar cells
- Solar water heater
- Solar crops drying
- Solar irradiation data analysis

Current projects:

As above

Joint research programmes carried out with:

- UN FSSTD (1984-1987; on energy in general, including application of solar photovoltaics for water pumping)

Suggested areas of co-operation with other research institutes:

- Development of solar water heater (materials research, especially
- coating materials)
- Crop drying
- Solar water pumping (for fresh water and saline or brackish for coastal areas)

IRAN

045. MECHANICAL ENGINEERING DEPARTMENT, UNIVERSITY OF SHIRAZ

Shiraz
Islamic Republic of Iran

Telephone: 51001-2663

Director: Dr. M.A. Yaghoubi, Chairman

Contact person: Dr. M.A. Yaghoubi

10 professional staff (PhD)

Government funded Annual budget 1984: US$ 420,000

Areas of research:

- Simulations
- Solar energy
- Solar distillation
- Wind energy
- Fluid flow
- Aerodynamics
- Combustion

Current projects:

- Modelling in energy consumption
- Passive cooling of buildings in hot areas
- Combustion

Suggested areas of co-operation with other research institutes:

- Joint research in any of the fields listed under 'Areas of
- research'

046. SOLAR ENERGY CENTER

Engineering School
Shiraz University
Shiraz
Islamic Republic of Iran

Telephone: 51001-2674

Contact person: Dr. M.A. Yaghoubi, Assistant Professor

2 professional staff (PhD)

Government funded Annual budget 1984: US$ 10,000

Areas of research:

- Solar desalination
- Solar passive cooling
- Solar radiation measurements
- Wind Energy

Current projects:

- Solar desalination
- Solar radiation in Shiraz

Suggested areas of co-operation with other research institutes:

- Passive cooling
- Solar desalination

IRAQ

047. SOLAR ENERGY RESEARCH CENTRE

Jadiryh
P.O. Box 13026
Baghdad
Iraq

Telex: 2187

Director: Mrs. N.I. Al-Hamdani

Contact person: Mrs. N.I. Al-Hamdani

12 professional staff

Government funded

Areas of research:

- Engineering and industrial application
- Agricultural and biological application
- Photochemical conversion and storage,
- Collectors
- Solar greenhouse

Current projects:

Solar research and development in Iraq (see Sunworld, vol 7, No. 2, 1983, page 51)

Joint research programmes carried out with:

Solar Greenhouses project with Royal Scientific Society in Jordan

Suggested areas of co-operation with other research institutes:

- Photovoltaic water pumping
- Water desalination

IVORY COAST

048. INSTITUT DE RECHERCHE SUR LES ENERGIES NOUVELLES (IREN)

IREN - Universite
01BPV34, Abidjan
Ivory Coast

Telephone: (225) 44 08 59
Ivory Coast

Telex: RECTU-CI
3469

Director: Mr. Patrice Carrara

20 professional staff (6 PhD)

Government and private funded

Annual budget 1984: US$ 120,000

Areas of research:

- Solar energy
- Biomass, biotechnology
- Applied nuclear physics (environment, biology, medicine)

Current projects:

Solar energy section
Photovoltaic systems:
- Monitoring, evaluation and optimization of the photovoltaic systems installed in the Ivory Coast;
- Behavioural study of photovoltaic system components under high-humidity tropical climate conditions;
- The interdigitate multi-junction photovoltaic cell;
- Optimized automatic operation of an average size multipurpose photovoltaic system (for rural areas).

Solar cold:
- Solar refrigeration by the solid absorption method;
- Solar climate control of dwelling areas by dehumidification.

Contribution to the energy autonomy of a rural African village:
- The popularization among the public of the rural use of photovoltaic systems and biogas digestors, and the instruction of the public in the operation of these systems through the educational means of a regional secondary school (lycee).

Suggested areas of co-operation with other research institutes:

- Biomass, biotechnology
- Solar energy

JORDAN

049. MECHANICAL ENGINEERING DEPARTMENT, UNIVERSITY OF JORDAN

Amman
Jordan

Telephone: 84 35 55 Telex: 21629
UNV.JO

Director: Dr. Munif Hijazi

Contact person: Dr. Mohamed Alsaad, Vice-Dean

3 professional staff (PhD)

University funding Annual budget 1984: US$ 6,000

Areas of research:

- Solar water heating
- Flat plate solar collectors
- Wind energy
- Thermal storage
- Solar water desalination

Current projects:

- Long-term performance of solar water heaters
- Generation of electricity from wind energy
- Design and performance of stratified storage tank

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research'

050. ROYAL SCIENTIFIC SOCIETY (RSS), SOLAR ENERGY RESEARCH CENTER (SERC)

P.O. Box (925 819)
Amman
Jordan

Telephone: 84 47 00-9 Telex: 21276 RAMAH JO Cable: ERRAMAHA

Director: Dr. F. Daghestani

Contact person: Dr. Hani El-Mulki, Director, SERC

13 professional staff (5 PhD)

Private funded plus research grant

Annual budget 1984: US$ 633,396

Areas of research:

- Solar water heater
- Space heating
- Metrological data
- Photovoltaics application and testing
- Wind energy applications

Current projects:

- Solar water heater for large application
- Testing of photovoltaics - panels
- Solar house (space heating)
- Pumping of drinking water using wind mills

Commercialized projects:

Solar water heater

Joint research programmes carried out with:

- Jordan Natural Resource Authority
- Jordan Drinking Water Authority
- German Agency for Technical Cooperation
- Kuwait Institute for Scientific Research

KENYA

051. DEPARTMENT OF MECHANICAL ENGINEERING, UNIVERSITY OF NAIROBI

P.O. Box 30197
Nairobi
Kenya

Telephone: 334244-2383 Cable: Varsity, Nairobi

Director: Dr. J.K. Musuva

Contact person: Dr. F.B. Sebbowa, Lecturer

3 professional staff (PhD)

Government funded plus equipment donation of Commonwealth Science Council

Annual budget 1984: US$ 14,000

Areas of research:

- Solar energy crop drying systems
- Water and air heating

Current projects:

- Prototype studies on solar crop drying system for the medium scale pyrethrum farmers of Kenya
- Bypass and multipass solar air heaters
- Optimization of the arrangement of flat solar collectors near the equator

Commercialized projects:

Optimization of the arrangement of flat solar collectors near the equator

Joint research programmes carried out with:

Not directly, except via 'The Africa Energy Programme', sponsored by the Commonwealth Science Council (CSC), Marlborough House, London, SW1Y 5HX

Suggested areas of co-operation with other research institutes:

Agricultural crop drying, especially on devices directly applicable to rural farming communities.

052. KENYA INDUSTRIAL RESEARCH AND DEVELOPMENT INSTITUTE

P.O. Box 30650
Nairobi
Kenya

Telephone: 557988, 557762 Cable: REDEV, Nairobi

Contact person: Mr. Katambo Wakano, Public Relations Officer

Areas of research:

- Photovoltaic solar water pump
- Solar refrigerator

Current projects:

as above

Joint research programmes carried out with:

- Ministry of Water Development, Kenya
- GTZ
- KIRDI
- University of Nairobi

MADAGASCAR

053. DELEGATION UNIVERSITAIRE AUX ENERGIES NOUVELLES (D.U.E.N.)

Universite de Madagascar
Rectorat
B.P. 566
Antananarivo
Madagascar

Telephone: 24 14-415/566

Director: Prof. Edmond Razafindrakoto, Delegate Co-ordinator

6 professional staff (PhD)

Sources of support include Rectorate of the University of Madagascar and national, foreign and international organizations

Areas of research:

- Solar thermal conversion
- Solar photovoltaic cells, modules and systems
- Biomass
- Wind energy
- Geothermic energy

Current projects:

- Solar radiation measurements
- Solar driers
- Solar water desalination/distillation
- Testing and research on small biogas devices

Commercialized projects:

Solar system drying wood

Joint research programmes carried out with:

- Some laboratories of French universities (Perpignan, Ocean Indien, La Reunion)
- Some agencies of the Ministries for Research, Energy etc.

Suggested areas of co-operation with other research institutes:

Preparations for entering into joint research programmes with some developing countries of the Indian Ocean under way.

MALAWI

054. POLYTECHNIC

7/Bag 303, Polytechnic
Department of Mechanical Engineering
Chichiri 3, Blantyre, Malawi

Telephone: 670411

Director: Mr. A. Kambalametore

Contact person: Prof. J. Harris, Head, Mech. Eng.

1 professional staff

Private funded Annual budget 1985: MK 3,000

Areas of research:

- Solar water heating systems
- Solar air heating

Current projects:

- Low cost solar water heater
- Solar water heating systems
- Solar air heating
- Solar water control valve

Commercialized projects:

- Solar water heating system

Suggested areas of co-operation with other research institutes:

- All areas

055. UNIVERSITY OF MALAWI, THE POLYTECHNIC

B.P. 303, Chichiri
Blantyre 3
Malawi

Telephone: 670 411 Telex: 46 13

Director: Mr. A.V. Kambalametore,

Contact person: Dr. G.M. Mhango

10 professional staff

Government funded Annual budget: As need arises

Areas of research:

- Solar heating
- Solar still
- Crop dryers
- Salt making

Current projects:

As above

Suggested areas of co-operation with other research institutions

Solar crop drying and solar still

MALAYSIA

056. FACULTY OF ENGINEERING, MECHANICAL ENGINEERING DEPARTMENT, UNIVERSITY OF MALAYA

Faculty of Engineering
University of Malaya
Kuala Lumpur
Malaysia

Telephone: 553466-200/204 Telex: UNIMAL MA 37453 Cable: UNIVSAL

Directors: Dr. Tengku Mohd. Azzman Shariffadeen, Dean, Faculty of Engineering; Mr. Goh Sing Yau, Head of Department

Contact person: Mr. Ong Kok Seng, Associate Professor

14 professional staff (PhD; Mechanical Engineering Department)

Annual budget 1984: US$ 100,000

Areas of research:

Solar energy utilization in Malaysia - thermal aspects

Current projects:

- Water and air heating
- Cooling
- Selective surface
- Distillation

Commercialized projects:

Water heating (domestic and swimming pool)

Suggested areas of co-operation with other research institutes:

Solar energy - thermal aspects

057. INSTITUT PENYELIDEKAN & KEMASUAN PERTANIAN MALAYSIA, MALAYSIAN RESEARCH AND DEVELOPMENT INSTITUTE (MARDI)

Petisurat 12301
Pejabat Pos Besar
Kuala Lumpur
Malaysia

Telephone: 35 64 01

Director: Hj. Dr. Mohd. Yusof Hashim, Director General

Contact person: Mr. Mohd. Zainal Ismail, Research Officer

6 professional staff

Government funded Annual budget 1984: US$ 40,000

Areas of research:

Testing of solar dryer for drying agricultural crops and food products such as ground-nut, coffee beans, noodles, salted fish, fish crackers etc.

Current projects:

As above

Joint research programmes carried out with:

Joint project with CHOGRM on solar dryers for agricultural crop in preparation

058. STANDARDS AND INDUSTRIAL RESEARCH INSTITUTE OF MALAYSIA (SIRIM)

P.O. Box 35
Shah Alam
Selangor
Malaysia

Telephone: 59 26 01
59 16 30

Director: Dr. Mohd. Mansor bin Haji Salleh, Director General (Controller), SIRIM

Contact person: Dr. Mohd. Mansor bin Haji Salleh; Dr. Chong Chok Ngee, Head, Research Unit, SIRIM

170 professional staff (6 PhD)

Mainly Government funded plus revenue from services to private and government sectors

Annual budget 1984: US$ 6.6 million

Areas of research:

- Metal industry technology
- Meteorology
- Building materials technology
- Energy technology
- Ceramics technology
- Pollution control technology

Current projects:

- Integrated biogas/solar energy systems (rural applications)
- Biogas from palm oil mill effluent for electricity generation
- Energy assessment and efficiency improvement in power stations
- Biomass energy - briquette fuels, alcohol fermentation, charcoal

Joint research programmes carried out with:

- JILA (Japan)
- Korea Advanced Institute of Science and Technology (KAIST)
- University of Malaya
- Universiti Kebangsaan, Malaysia
- Palm Oil Research Institute of Malaysia

Suggested areas of co-operation with other research institutes:

Joint research programmes in the above fields on a larger scale

059. DEPARTMENT OF PHYSICS, UNIVERSITI KEBANGSAAN MALAYSIA (UKM)

P.O. 13
Bangi
Selangor
Malaysia

Telephone: 03-350001, ext. 2890 Telex: MA 31496 Cable: UNIKEB

Director: Prof. Dr. Abd Hamid Abd Rahman

Contact persons: Dr. Mohd. Noh Dalimin, Lecturer

10 professional staff (7 PhD)

Government funded Annual budget 1984: US$ 100,000

Areas of research:

- Photovoltaics
- Solar drying and thermal system
- Solar refrigeration and cooling
- Solar radiation

Current projects:

- Solar radition mapping of Peninsula Malaysia
- Solar thermal system
- Solar photovoltaics

Joint research programmes carried out with:

New Energy Development Organisation, Japan

Suggested areas of co-operation with other research institutes:

All areas of energy, especially further co-operation on solar cooling

060. UNIVERSITI SAINS MALAYSIA

Minden
Pulau Pinang
West Malaysia
Malaysia

Telephone: 883822-108 Telex: MA40254 Cable: UNISAINS

Director: The Honourable, Datuk Musa Mohamad

Contact person: Prof. Sharom Ahmat, Deputy Vice-Chancellor (Research and Development)

8 professional staff (PhD)

Government funded Annual budget 1984: US$ 140,000

Areas of research:

- Photovoltaic conversion
- Biomass/biogas
- Drying (agricultural produce)
- Desalination

Current projects:

- Evaluation of the potential of biowastes as a potential source of energy
- Investigation of new materials for solar cells
- Water pumping using photovoltaic solar cells
- Solar smoke house
- Production of biogas from agricultural wastes
- Project SOPHOCLE
- Desalination

Joint research programmes carried out with:

- Malaysian Agricultural Development Authority (MADA)
- National Electricity Board of Malaysia
- French Government

MALI

061. LABORATOIRE DE L'ENERGIE SOLAIRE (L.E.SO.)

B.P. 134, Darsalam
Bamako
Mali

Telephone: 22 30 41 Telex: Telex Public

Director: Mr. Cheickna Traore

Contact person: Mr. Cheickna Traore

27 professional staff

Funded by Government and USAID

Annual budget 1984: US$ 3,351 (as provided by Government)
USAID project funding from 1978-1985: US$ 109,800

Areas of research:

(a) Solar energy:
- High and low temperature
- Photocells

(b) Windenergy
(c) Biomass

Current projects:

Project on renewable energy sources (involving the study and application of all forms of renewable energy: solar, wind and biomass)

Joint research programmes carried out with:

- Centre de Technologies Adaptee (CTA)
- Ecole Nationale des Ingenieurs (ENI)
- Centre de Recherche Fruitiere (CRF)
- Office Malien du Betail et de la Viande (OMBEVI)
- Ecole Normale Superieure (ENSUP)
- University of Perpignan (France)
- Sheladia Associated Inc. (USA)
- Operation Peche (Fisheries Operation)

MEXICO

062. INSTITUTO DE INGENIERIA, UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO (UNAM)

Ciudad Universitaria
Apartado 70-472
Delegacion Coyoacan
04510, Mexico, D.F.
Mexico

Telephone: (905) 548 0735 Telex: 1760155 CICME

Director: Dr. Luis Esteva Maraboto

Contact person: Prof. Luis Palacios-Hammeken, Assistant Director

175 professional staff (24 PhD)

Government funded Annual budget 1984: US$ 3,000,000

Areas of research:

- Solar refrigeration
- Experimental solar plant (tracting collectors)
- Automated system for measuring solar irradiation
- Absorber tubes for solar plant

063. INSTITUTO TECNOLOGICO Y DE ESTUDIOS SUPERIORES DE MONTERREY/ITESM

Department of Thermal Engineering
Succursal de Correos J
Monterrey, N.L.
Mexico

Telephone: (83) 58 20 00-107 Telex: 0382976 ITESME

Director: Dr. Jose A. Manrique

Contact person: Dr. Jose A. Manrique

3 professional staff (PhD)

Private funded Annual budget 1984: US$ 100,000

Areas of research:

- Photothermal water pumping systems
- Space heating and cooling
- Concentrators
- Photovoltaic water pumping systems

Current projects:

As above

Joint research programmes carried out with:

Agence Francaise pour la Maitrise de L'Energie, Paris, France

Suggested areas of co-operation with other research institutes:

As above

MOROCCO

064. ECOLE MOHAMMADIA D'INGENIEURS

B.P. 765
Rabat Adal
Morocco

Telephone: 726-47 Telex: 32939 M Cable: E.M.I. Rabat

Director: Prof. A. Alj

Contact person: Prof. A. Mojtabi, Head of Mechanical Department

10 professional staff (5)

Government funded Annual budget 1984: US$ 35,000

Areas of research:

- Solar heating and cooling
- Solar distillation
- Wind energy

Current projects:

- Construction of two units of solar distillation
- Study of a refrigeration unit

Joint research programmes carried out with:

- Laboratoire d'Energetique de l'ENSAM, Bordeaux I Talence, France
- I.M.S.T., 13003 Marseille
- Universite Mons, Laboratoire de Thermodynamique

NEPAL

065. BALAJU YANTRA SHALA SANITARY ENGINEERING LIMITED/BYSSEL

P.O. Box 2070, B.I.D., Balaju
Kathmandu
Nepal

Telephone: 214835 Cable: BYSSA

Director: Mr. Rajesh Prasad Shriwastab, General Manager

Contact person: Mr. Rajesh Prasad Shriwastab

2 professional staff

Private funded Annual budget 1984: US$ 140,000

Areas of research:

- Solar water heaters for urban and rural areas
- Solar space heating
- Solar drying

Current projects:

- Solar space heating - two houses
- Solar dryer for herbs
- Solar dryer for pulps

Joint research programmes carried out with:

Research Centre for Applied Science and Technology, Tribhuwan University, Kiritpur, Kathmandu, Nepal

Suggested areas of co-operation with other research institutes:

- Solar water heating
- Solar space heating

NIGERIA

066. DEPARTMENT OF MECHANICAL ENGINEERING, UNIVERSITY OF LAGOS

Lagos
Nigeria

Director: Prof. H. Enahoro, Head of Department

Contact person: Prof V.A. Akinsete

5 professional staff (involved in solar energy work)

Government funded Annual budget 1984: US$ 20,000

Areas of research:

Low temperature applications for:
- water distillation
- water heating
- crop drying
- cooling
- Development of cheap solarimeters using Si-cell and amp-hour meters

Current projects:

- Design and development of prototype solar water heaters for Nigeria
  using locally-available materials
- Design and development of charcoal-bed solar stills
- Solar radiation intensities in Nigeria using available meteorological data
- Design and development of a prototype grain dryer for use in Nigeria

Commercialized projects:

Charcoal-bed, roof-type solar still

Suggested areas of co-operation with other research institutes:

Exchange of information and visits

067. NIGERIAN INSTITUTE OF PLANT SCIENCE AND SOLAR ENERGY/TECHNOLOGY

149, Hospital Road
Aba
Imo State
Nigeria

Director: Dr. Ephraim Nkem Okeya

Contact person: Dr. Ephraim Nkem Okeya

4 professional staff

Private funded Annual budget 1984: US$ 95,000-150,000

Areas of research:

- Fusion reactor development
- Electro-chemistry
- Electro-analytical chemistry
- Aqua culture/agriculture
- Desalination
- Cooling/drying facilities
- X-ray beams
- Gammaray

Current projects:

- Research contract service
- Community/rural technologies
- Phonons/photons
- Surge performance
- Aqua culture/agro-based parastatals
- Health hazards - solar energy
- Food protein
- Plasmalemma

Suggested areas of co-operation with other research institutes:

- Thermo-therapy (medical) for clinics, hospitals
- Vaccine production - pharmaceuticals
- Aqua culture/agriculture - industries (allied)

068. THERMAL AND PASSIVE ENERGY LABORATORY, UNIVERSITY OF IFE

P.O. Box 1035
Ile-Ife
Nigeria

Telephone: IFE 2291 Cable: NGOKA UNIFE NIGERIA

Director: Mr. Nelson I. Ngoka

Contact person: Mr. Nelson I. Ngoka

6 professional staff (2)

Government funded Annual budget 1984: US$ 50,000

Areas of research:

- Rural energy systems in Nigeria
- Renewable forms of energy
- Passive solar building technology
- Energy conservation
- Energy policy
- Thermal comfort

Current projects:

- Design of cheap solar water heater for developing countries
- Rural energy sustems in southern Nigeria
- Passive solar building design and comfort studies

Commercialized projects:

Energy conservation strategies for industrial sector

Joint research programmes carried out with:

The research unit is in close contact with various research institutions and universities in various parts of the world. There is, however, no joint project at present

Suggested areas of co-operation with other research institutes:

- Energy conservation
- Rural energy systems
- Passive solar building technology

PAKISTAN

069. NATIONAL INSTITUTE OF SILICON TECHNOLOGY

15-B, Street-44, F-8/1
Islamabad
Pakistan

Telephone: 851987
850847
Telex: 5538 NIE PK Cable: SILICONCEN

Director: Dr. Atique Mufti

Contact person: Dr. Atique Mufti

33 professional staff (3 PhD)

Government funded Annual budget 1985: US$ 1,000,000

Areas of research:

- Silicon technology
- Photovoltaics
- Research and development starting from quartz to making of solar cells and silicon chips

Current projects:

- As above

Joint research programmes carried out with:

- Arizona University, USA
- University of Miami, USA
- Marmara Research Institute, Turkey
- Some other collaborative projects are being finalized

Suggested areas of co-operation with other research institutes:

Prepared to enter into joint research programmes.

070. PAKISTAN COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (PCSIR)

Solar Energy Division
P.O.Box 672
Shahrah-e-Kamal Ataturk
Karachi-0109
Pakistan

Chairman: Dr. Naeem Ahmad Khan

Contact person: Dr. Rafiq Ahmad Siddiqi, Principal Scientific Officer, PCSIR Laboratories, Shahrah-e-Jalal-ud-Din Roomi, Lahore-16

550 professional staff (105 PhD)

Government funded Annual budget 1985: US$ 5,000,000

Areas of research:

- Solar water heating
- Solar cooking
- Solar desalination
- Solar architecture
- Solar drying

Current projects:

- Solar heaters
- Solar cookers
- Solar architecture
- Solar drying

Joint research programmes carried out with:

The Division is in close contact with the Clean Energy Institute of University of Miami, USA, and a Clean Energy Institute for Pakistan is on the anvil.

Suggested areas of co-operation with other research institutes:

- Solar architecture
- Rural energy systems
- Passive solar building technology

071. UNIVERSITY OF ENGINEERING AND TECHNOLOGY, PESHAWAR

Directorate of Research
N.W.F.P. University of Engineering
and Technology
P.O.Box 814
Peshawar
Pakistan

Telephone: 0521-41562

Director: Mr. Sultan Daood, Head

Contact person: Prof. I.H. Shah, Director

78 professional staff (3PhD)

Government funded Annual budget 1984: US$ 2,200 000

Areas of research:

- Solar water heating
- Solar cooker
- Solar desalination

Current projects:

Solar assisted tobacco barn

Joint research programmes carried out with:

- Colorado State University, USA
- Pakistan Council for Scientific and Industrial Research
- Appropriate Technology Development Organization

Suggested areas of co-operation with other research institutes:

- Selective coating
- Solar ponds
- Silicon cell

PAPUA NEW GUINEA

072. DEPARTMENT OF MECHANICAL ENGINEERING, PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

Private Mail Bag
Lae
Papua New Guinea

Telephone: 42 4999-2124
45 7249
Telex: NE42428
Cable: UTECH, LAE, PNG

Director: Prof. W.C.K. Wong

Contact person: Mr. S.J. Bialostocki, Associate Professor

16 professional staff (5 Phd)

Government funded

Annual budget 1984: US$ 100,000

Areas of research:

- Solar and solar assisted drying (air heaters)
- Solar air-conditioning
- Solar radiation monitoring

Current projects:

- Re-installation of solar radiation monitoring system
- Development and testing of air heaters and driers
- Monitoring and modification of solar air-conditioners

Commercialized projects:

- Two on solar assisted driers
- Two on biomass conversion

Suggested areas of co-operation with other research institutes:

- Solar drying
- Biomass utilization

PEOPLE'S REPUBLIC OF CHINA

073. BEIJING SOLAR ENERGY RESEARCH INSTITUTE (BSERI)

Huan Yuan Road
Beijing
People's Republic of China

Telephone: 27 75 21

Director: Mr. Gong Bao

Contact person: Mr. Gong Bao

117 professional staff

Government funded

Areas of research:

- Solar
- Biomass

Current projects:

- Anaerobic
- Biogas digester
- Cooking
- Building design
- Irrigation
- Collectors/concentraters
- Distributor/collector systems
- Manufacturing technology
- Materials research
- Passive systems
- Photovoltaics
- Solar cell design
- Solar thermal
- Space heating
- Food drying
- Greenhouses
- Water heating

Commercialized projects:

- Solar cells
- Solar water collectors

Suggested areas of co-operation with other research institutes:

- Solar
- Biomass

074. GENERAL RESEARCH INSTITUTE FOR NON-FERROUS METALS (GRINM)

2 Xin Jie Kou Wai Dajie
Beijing
People's Republic of China

Telephone: 66 41 31 Cable: 2589 Beijing

Director: Mr. Wan Qun

Contact persons: Mr. Zhang Chun, Mr. Xiao Dechuan

20 professional staff (1PhD)

Government funded Annual budget: US$ 10,000-15,000

Areas of research:

Si solar cells

Current projects:

- Solar cells made of casting Si polycristal
- a-Si solar cells produced by glow-discharge Method

075. SHANGHAI INSTITUTE OF ENERGY

1960 Long Hua Road
Shanghai
People's Republic of China

Director: Mr. Yu Shan-qing

Government funded

Areas of research:

- Basic materials for solar energy applications
- Solar thermal conversion
- Solar photovoltaic conversion

Commercialized projects:

Solar collector (water heater)

Suggested areas of co-operation with other research institutes:

Basic materials for solar energy application

076. SHANGHAI NON-FERROUS METALS RESEARCH INSTITUTE

P.O. Box 8402
Shanghai
People's Republic of China

Telephone: 28 51 93, 28 57 39

Director: Mr. Cao Guo-Chen, Vice President, Chief Engineer

Contact persons: Mr. Wang Zhengming, Mr. Shi Shengdee, Engineers

517 professional staff

Government funded

Areas of research:

- Electronic materials
- Semiconductor materials (silicon)
- Solar cells
- Solar grade silicon
- Aluminium alloy solar water heater
- Superconductor materials
- Rare metals
- Non-ferrous metals and alloys

Current projects:

- Casting polycristalline silicon ingot
- Casting polycristalline silicon solar cells
- Low-cost solar grade silicon
- Aluminium alloy solar water heater

Suggested areas of co-operation with other research institutes:

- Casting polycristalline silicon solar cells
- Photovoltaic solar energy conversion
- Water heating

077. SOLAR ENERGY RESEARCH SECTION, SHANGHAI INSTITUTE OF MECHANICAL ENGINEERING

516 Jun Gong Road
Shanghai 200093
People's Republic of China

Telephone: 43 30 40 Cable: 1191

Director: Prof. Chen Zhihang, President of Institute

Contact person: Prof. Gu Jingxian, Head of Section

25 professional staff (5 PhD)

Government funded

Areas of research:

- Solar power pilot station (thermo generation)
- Collector
- Water and air heating
- Drying
- Energy conservation

Current projects:

- Collector
- Drying
- Energy conservation

Suggested areas of co-operation with other research institutes:

- Solar drying
- Energy conservation

078. ZHEJIANG RESEARCH INSTITUTE FOR BIOGAS AND SOLAR ENERGY (ZIBS)

Hargzhou
People's Republic of China

Telephone: 43965 Cable: 2889

Director: Mr. Xu Zeng-fu

Contact person: Mr. Xu Zeng-fu

21 professional staff

Government funded

Areas of research:

- Solar passive systems
- Solar energy storage
- Solar collectors
- Solar drying
- Bioconversion
- Biomass applications
- Biomethanation system

Current projects:

- Solar drying of bamboo products
- Solar diluting of sea water

Commercialized projects:

- Solar water heating
- Solar drying

Suggested areas of co-operation with other research institutes:

- Bioconversion and biomass applications
- Solar applications

PHILIPPINES

079. PHILIPPINE NATIONAL OIL COMPANY-ENERGY RESEARCH AND DEVELOPMENT CENTER (PNOC-ERDC)

Don Mariano Marcos Avenue Diliman
Quezon City
Philippines

Telephone: 97 76 11 Telex: 63667 PNOC PN Cable: PHILNOCO

Director: Dr. Ibarra E. Cruz, Manager

40 professional staff (3 PhD)

Government and private funded Annual budget 1983: Phil.Pesos 11,300,000

Areas of research:

- New and renewable sources of energy

Current projects:

- Pilot solar power plant
- ERDC-PAGASA study on the application of windmills (Netherlands Windmill Project)
- Medium-scale wind power systems for rural electricity and fertilizer production
- An assessment of the potential for the utilization of biomass fuels in the Philippines
- Gasification of densified rice hulls
- Direct heat gasifier systems
- Analysis of solar water heating systems

Commercialized projects:

- Solar water heater - hotels and restaurants

Joint research programmes carried out with:

- U.S. Agency for International Development (USAID)
- United Nations Development Programme (UNDP)
- United Nations Educational, Scientific and Cultural Organizations (UNESCO)
- Federal Republic of Germany
- Association for the Growth of Systematized Agricultural Technology (AGSAT)

- INSTO Foundation
- Bureau of Energy Development (BED)
- National Science and Technology Authority (NSTA)
- National Food Authority (NFA)
- National Institute of Biotechnology and Applied Microbiology (BIOTECH)
- Philippine Council for Industrial Energy Research and Development (PCIERD)

080. THE INTERNATIONAL RICE RESEARCH INSTITUTE (IRRI)

P.O. Box 933, Manila
Philippines

Telephone: 88 48 69, Telex: (ITT)45365 RICE INST PM
88 45 14, 673-5003 (RCA)22456 IRI PH Cable: RICEFOUND
673-5004, 673-5005 (EASTERN) 63786 RICE PN MANILA

Director: Mr. M.S. Swaminathan, Director General

Contact persons: Mr. M.S. Swaminathan, Mr. Clarence W. Bockhop, Head, Department of Agricultural Engineering

81 professional staff (70 PhD)

Funded by Consultative Group on International Agricultural Research

Areas of research:

- Photosynthesis
- Solar drying of grains

Current projects:

Several projects in the field of enhancing the efficiency of utilization of solar energy for rice and development of solar grain drying technologies

Joint research programmes carried out with:

National research systems in most rice-growing countries

Suggested areas of co-operation with other research institutes:

Development of solar grade silicon from rice hulls

REPUBLIC OF KOREA

081. KOREA INSTITUTE OF ENERGY & RESOURCES (KIER)

P.O. Box 339 Daejeon
Chungnam
Korea

Telephone: 822-970 Telex: K45507 Cable: KIEREL

Director: Mr. Keung-Shik Park, President

Contact person: Mr. Paul Chungmoo Auh, Director, Solar R&D Department

30 professional staff (Solar R&D; 4 PhD)

Government funded Annual budget 1984: US$ 500,000 (solar R&D)

Areas of research:

- Passive solar buildings
- Active solar buildings
- Photovoltaics
- Biomass
- Insulation measurements and equipment tests

Current projects:

- Passive building design
- Active DHWS design
- Photovoltaic system design for remote areas
- Methane generator design
- Insolation measurements and collector performance tests

Commercialized projects:

Active solar heating and DHWS

Joint research programmes carried out with:

A.F.M.E. France - solar heating

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research'

SAUDI ARABIA

082. ENERGY RESOURCES DIVISION, RESEARCH INSTITUTE, UNIVERSITY OF PETROLEUM AND MINERALS

P.O. Box 144,
Dhahran
Saudi Arabia

Telephone: 03 860-3554/3555 Telex: 601913 UPM RS SJ Cable: ALJAMAAH

Director: Dr. A.E. Dabbagh

Contact person: Dr. Jasem M. Al-Ansari, Manager, Energy Resources Division

10 professional staff (5 PhD)

Government and private funded Annual budget 1984: US$ 7,000,000 to US$ 8,000,000

Areas of research:

- Develop non-petroleum related energy systems and devices with primary emphasis on the resources and environment of Saudi Arabia
- Application of solar and wind energy resources in the Kingdom and establish an energy input/output data base
- Establish energy conservation measures in residential, industrial and office buildings

Current projects:

- Non-convecting salt gradient solar pond programme
- Climatic chamber tests
- Testing of domestic solar water heater in campus house
- Solar radiation monitoring
- In-house domestic solar water heater
- Solar radiation monitoring

Joint research programmes carried out with:

- Battelle, Columbus, USA
- KISR, Kuwait

SENEGAL

083. ECOLE NATIONALE SUPERIEURE UNIVERSITAIRE DE TECHNOLOGIE (ENSUT)

P.B. 5085
Dakar Fann
Senegal

Telephone: 23 00 17 Telex: UY 8384

Director: Mr. Souleymane Seck

Contact person: Mr. Pierre Viaud, Professor

100 professional staff (15 PhD)

Government funded Annual budget 1984: US$ 160,000

Areas of research:

- Wind energy
- Solar energy
- Biomass
- Development of natural products

Current projects:

Research and development projects in the area of biotechnology

Commercialized projects:

Installation in the bush of wind energy units, designed and produced at ENSUT for water-pumping and electrification

Suggested areas of co-operation with other research institutes:

Biomass

084. SOCIETE INDUSTRIELLE DES APPLICATIONS DE L'ENERGIE SOLAIRE (SINAES)

B.P. 1277
21/A - Zone/B
Dakar
Senegal

Telephone: 21 12 08
21 90 12

Telex: KARELEC
661 SG

Director: Mr. Mohamed-Ali Toure

Contact person: Mr. Aliou Ba, Chief, Technical Service

24 professional staff (4 PhD)

Government and private funded Annual budget 1984: US$ 500,000

Areas of research:

- Water pumping
- Water heating
- Rural solar/wind-power plant
- Biomass

Current projects:

- Domestic water heating
- P.V. solar pumping stations
- Maintenance programme (annual)
- Manufacture of solar water heaters

Joint research programmes carried out with:

- CERER - Dakar, Senegal
- CRES - Bamako, Mali
- ENSUT - Dakar, Senegal
- Total - Paris, France

Suggested areas of co-operation with other research institutes:

- Engineering
- Windmills
- Rural Electrification
- Biomass
- Water pumping
- Desalination

SEYCHELLES

085. MINISTRY OF NATIONAL DEVELOPMENT, TECHNOLOGY FOR DEVELOPMENT DIVISION

P.O.Box 199
Victoria
Seychelles

Telephone: 76631

Director: Dr. Selwyn Gendron

4 professional staff (1 PhD)

Government and funded Annual budget 1985: US$ 100,000

Areas of research:

- Biomass gasification
- Biogas production
- Energy policy

Current projects:

- New and renewable energy project
- Energy policy research

Commercialized projects:

- One local assembly of solar water heating system

Joint research programmes carried out with:

- University of Reunion, Reunion, St. Clothilde, P.O.Box 5

SINGAPORE

086. DEPARTMENT OF BUILDING SCIENCE, NATIONAL UNIVERSITY OF SINGAPORE

Kent Ridge Campus
Singapore 0511
Singapore

Telephone: 77 56 666-223 Telex: UNISPO RS 33943 Cable: UNIVSPORE

Director: Prof. Bill B.P. Lim

Contact person: Prof. Bill B.P. Lim

11 professional staff (9 PhD)

Government funded Annual budget 1984: US$ 800,000

Areas of research:

- Energy conservation in buildings
- Passive design of buildings
- Passive use of solar energy

Current projects:

- Low-energy housing
- Solar dryer for clothes in high rise buildings
- Efficiency of solar hot-water heating
- Solar radiation measuring
- Computer simulation of energy utilization in buildings

Joint research programmes carried out with:

Development and Building Control Division, Public Works Department, Singapore, on energy conservation building regulations (PWD Ministry of National Development Building, Maxwell Road, Singapore 0106)

Suggested areas of co-operation with other research institutes:

- Computer simulation of energy conservation and passive design
- Solar air conditioning for the hot, humid tropics
- Passive use of solar energy

087. FACULTY OF ENGINEERING, NATIONAL UNIVERSITY OF SINGAPORE

Kent Ridge Campus
Singapore 0511
Singapore

Telephone: 77 56 666 Telex: UNISPO RS 33943 Cable: UNIVSPORE

Director: A/Prof. Aun Neow Poo, Dean, Faculty of Engineering

Contact person: A/Prof. Aun Neow Poo

160 professional staff

Government funded Annual budget 1984: US$ 12,000,000

Areas of research:

- Solar cooling
- Photovoltaic applications
- Solar ponds
- Solar heating
- Photovoltaic devices

Current projects:

- Solar air-conditioning
- Photovoltaic water pumping
- Solar ponds
- Simulation of solar collection systems

Joint research programmes carried out with:

GTZ, FRG

Suggested areas of co-operation with other research institutes:

As stated under 'Current projects'

088. PHYSICS DEPARTMENT, NATIONAL UNIVERSITY OF SINGAPORE

Kent Ridge Campus
Singapore 0511
Singapore

Telephone: 77 56 666 Telex: NUSBUR
RS 51112

Director: Prof. Y.K. Lim, Head, Department of Physics

Contact person: Prof. A. Rajaratnam, Professor of Physics

2 professional staff working in this area

Government funded Annual budget 1984: US$ 3,000

Areas of research:

- Solar radiation measurements
- Photovoltaic conversion

Current projects:

- Atmospheric water vapour absorption of solar radiation
- Measurements of total, scattered and in three wave band regions
- Building up an amorphous silicon facility

Joint research programmes carried out with:

Space Science Division, Naval Research Laboratory,
Washington D.C. 20375

Suggested areas of co-operation with other research institutes:

The two above-mentioned related research areas

SRI LANKA

089. CEYLON INSTITUTE OF SCIENTIFIC AND INDUSTRIAL RESEARCH

363, Bauddaloka Mawatha
Colombo 7
Sri Lanka

Telephone: 93807

Director: Mr. M.S. Wijeratne

Contact person: Dr. S.A. Abeysekera, Head, Pilot Plant and Design Section

20 professional staff

Government funded Annual budget 1984: US$ 300,000

Areas of research:

- Solar desalination
- Drying
- Cookers
- Water heaters

Current projects:

- Solar dehydration of fruits and vegetables
- Solar water heating of homes and tourist hotels

Suggested areas of co-operation with other research institutes:

Installation of water heaters on large scale, e.g. for a 200 room hotel

SYRIAN ARAB REPUBLIC

090. GENERAL ORGANIZATION OF ENGINEERING INDUSTRIES

Baramkeh St.
P.O.Box 3120
Damaskus
Syrian Arab Republic

Telephone: 214650 Telex: 411035 SY

Director: Eng. Mandouh Al-Monajed

Contact person: Dr. Mishel Al-Haddad, Supervisor

15 professional staff (1 PhD)

Government funded

Areas of research:

Areas in connection with investment of solar equipment for hot water:
- projection and construction work
- production work
- project studies and supervision

Current projects:

Organization is supplier for solar equipment for heating water for domestic use (houses of workers at Damaskus International Airport

Joint research programmes carried out with:

- Organization is engaged in joint research programmes with other institutions in the country, such as the General Co. for Studies and Technical Consulting.

Suggested areas of co-operation with other research institutes:

- water heating for domestic and industrial uses
- air conditioning

091. INDUSTRIAL TESTING AND RESEARCH CENTER

S.A.R. Mouada
E1A P.O.Box 845
Damaskus
Syrian Arab Republic

Telephone: 664095
664083

Cable: INTEST

Director: Eng. Hisham Sharafly

Contact person: Eng. Hisham Sharafly, Director General

135 professional staff (4 PhD)

Government and private funded Annual budget 1985: US$ 2,000,000

Areas of research:

- Industrial research
- Petroleum
- Miscellaneous including power and energy

Current projects:

- Research for cement and building material
- Research for petroleum and food industry

Suggested areas of co-operation with other research institutes:

- Same areas as indicated under 'Areas of research'

092. SCIENTIFIC STUDIES AND RESEARCH CENTER (SSRC)

P.O.Box 4470
Damascus
Syrian Arab Republic

Telephone: 772603, 772604, Telex: 411374 SY

Director: Dr. A.E. Chahid

Contact person: Dr. A.H. Mansour, Deputy Director General

14 professional staff (3 PhD)

Government funded Annual budget 1985: US$ 100,000

Areas of research:

- Photovoltaics
- Thermal conversion of solar energy
- Solar heating and cooling systems
- Solar radiation and meteorological data

Current projects:

- Photovoltaic cell encapsulation
- Photovoltaic panel design, thermally selective absorbing plates
- Solar heating systems

Joint research programmes carried out with:

- Faculty of Electrical and Mechanical Engineering, University of Damascus
- Assad Academy, Aleppo, Syria
- CEN, B.P., Alger - Gare, Algeria

TANZANIA

093. CENTRE FOR AGRICULTURAL MECHANIZATION AND RURAL TECHNOLOGY (CAMARTEC)

P.O.Box 764
Arusha
Tanzania

Telephone: 3594
3666

Telex: 42115 CAMART TZ

Director: Edward Ngaiza

Contact person: Frederick Sumaye, Technologist

12 professional staff

Government funded

Annual budget 1985: US$ 228,500

Areas of research:

- Agricultural mechanization - hand tool, animal drawn implements/equipements
- Rural (appropriate) technologies - biogas, solar energy, devices, water lifting devices, wind energy and energy conservation

Current projects:

- Ox drawn ploughs, planters, cultivators, carts, windpower, sugar cane crusher, coffee pulper, biogas plants (various designs), biogas appliances, solar water heaters. solar crop driers, cookstoves

Commercialized projects:

- Most of Centre's devices are rural (domestic) oriented rather than industrial. Most of the devices under 'Current projects' are applied in fields or homes.

Suggested areas of co-operation with other research institutes:

- Any area mentioned under 'Areas of research'.

094. INSTITUTE OF PRODUCTION INNOVATION (IPI), UNIVERSITY OF DAR ES SALAAM

P.O.Box 35075
Dar Es Salaam
Tanzania

Telephone: 49192
48571

Telex: 41561 UNIVIP TZ

Director: Mr. Klaus-Peter Stoermer

Contact person: Mr. Klaus-Peter Stoermer

10 professional staff

Government funded

Annual budget: TZS 1,000,000
US$ 1,000,000

Areas of research:

- Emphasis on energy, agriculture and transport, solar refrigeration
- Ethanol as fuel from agricultural wastes
- Wind energy for water pumping
- pressing of oil-bearing seeds

Current projects:

- Solar adsorption refrigerator (ethanol-charcoal)
- Ethanol production from agricultural wastes
- Water pumping by wind energy

Commercialized projects:

- 80t and 20t mechanical oil press
- Seed decorticator
- Windmill - Savonius rotor type

Joint research programmes carried out with:

- Faculty of Engineering (FoE), Dar Es Salaam
- University of Ottawa, Dep. of Civil Engineering, Faculty of Science and Engineering, Canada

Suggested areas of co-operation with other research institutes:

- Solar energy for refrigeration
- Solar Energy for water pumping

095. TANZANIA NATIONAL SCIENTIFIC RESEARCH COUNCIL (UTAFITI)

Kivukoni Front
B.P. 43032
Dar es Salaam
Tanzania

Telephone: 25 802 Telex: 41177 Cable: UTAFITI

Director: Prof. A.S. Msangi, Director General

Contact person: Prof. A.S. Msangi

13 professional staff (2 PhD)

Government and private funded Annual budget 1984: US$ 300,000

Areas of research:

Rural energy

Current projects:

Dodoma Rural Energy Project

Suggested areas of co-operation with other research institutes:

Solar energy utilization in cooking and lighting

096. DEPT. OF AGRICULTURAL ENGINEERING AND LAND PLANNING, UNIVERSITY MOROGORO

University Morogoro
P.O. Box 3003
Tanzania

Telephone: 2511-337 Telex: 55308 UNIVMOG Cable: UNIAGRIC MOROGORO

Director: Dr. G.C. Mrema, Senior Lecturer

Contact person: Dr. G.C. Mrema

5 professional staff (1 PhD)

Funded by Government and The Commonwealth Science Council

Annual budget 1984: US$ 300,000

Areas of research:

Solar crop drying

Current projects:

Solar crop drier for pyrethrum flowers, fish and tobacco for use in rural areas

Joint research programmes carried out with:

- Department of Agricultural Engineering, Nairobi University, Kenya
- Department of Agricultural Engineering, Makarere University,
- Uganda

Suggested areas of co-operation with other research institutes:

- Solar crop drying for rural applications
- Photovoltaics
- Solar pumps

THAILAND

097. ASIAN INSTITUTE OF TECHNOLOGY (AIT)

G.P.O. Box 2754
Bangkok
Thailand

Telephone: 51 68 321-22
52 39 300-13, 52 38 891-93
Telex: 84276TH
Cable: AIT-BANGKOK

Director: Prof. A.M. North, President, AIT

Contact person: Prof. G.Y. Saunier, Chairman, Energy Technology Div.

Government and private funded
Annual budget 1984: US$ 900,000

Areas of research:

- Solar heating, drying and radiation
- Solar air conditioning and refrigeration
- Testing of solar thermal collectors performance
- Generation of electricity with photovoltaic systems
- Solar pond

Current projects:

- Development of a dynamic testing method to determine solar thermal collector performance
- Village size thermal solar refrigerator
- Field trails on solar photovoltaic refrigerator
- Solar water heating test systems of Royal Orchid Hotel (consultancy project)
- Development of multifuel intermittent ice making machine appropriate for remote rural areas
- Development of a multi-biomass fuel pump for rural area

Commercialized projects:

- 800m^2 of solar heater on Royal Orchid Hotel
- Saunier Dynamic Testing Method and Bench (one in National Thai Energy Authorities, one in University of Lyon and CETIAT (France)

Joint research programmes carried out with:

- CRA, Gembloux University (M.J. Cane)
- TNO, Netherlands

Suggested areas of co-operation with other research institutes:

- Testing of solar thermal collectors performance
- Solar pond

098. DEPARTMENT OF SCIENCE SERVICE, PHYSICS AND ENGINEERING DIVISION

Rama 6 Road
Bangkok 10400
Thailand

Telephone: 281-5830

Director: Dr. Chalio Surasiti

Contact person: Mr. Pipat Panpaprai, Director Physics and Engineering Division

75 professional staff (1 PhD)

Government funded Annual budget 1984: US$ 300,000

Areas of research:

Solar energy for drying and water distillation

Current projects:

Use of solar energy for water distillation

Commercialized projects:

160 units of roof type solar still

Suggested areas of co-operation with other research institutes:

Solar still

099. ELECTRICITY GENERATING AUTHORITY OF THAILAND (EGAT)

Nonthaburi 11000
Thailand

Telephone: (02) 42 48 043 Telex: TH 82711 Cable: EGAT NONTHABURI

Director: Mr. Kasama Chatikavanij, General Manager

Contact person: Mr. Chaya Jivacate, Chief, Special Energy Division

46 professional staff (1 PhD)

Government and private funded Budget 1980-1984: US$ 2,500,000

Areas of research:

- Alternative energy
- Technology for electricity generation

Current projects:

Research, development, demonstration test and evaluation on solar Electricity (Photovoltaics and Thermodynamics)

Commercialized projects:

Wind Electricity (horizontal and vertical axis)

Joint research programmes carried out with:

- Chulalongkorn University
- King Mongkut's Institute of Technology, Thonburi Campus
- King Mongkut's Institute of Technology, North Bangkok Campus
- Prince of Songkhla University

100. **ENERGY INDUSTRY DEVELOPMENT OFFICE**

Office of Permanent Secretary
Ministry of Industry
Rama 6 Road
Bangkok 10400
Thailand

Telephone: 282 3835

Director: Mr. Ta-noo Vicharangsan, Chief

Contact person: Mr. Ta-noo Vicharangsan

4 professional staff

Government funded Annual budget 1984: US$ 100,000

Areas of research:

- Applications of photovoltaics in remote areas
- Applications of renewable energies (biomass, solar) in rural development activities

Current projects:

- Remote areas photovoltaics
- Ethanol as motor fuel

Commercialized projects:

Ethanol as motor fuel (as a blend with gasoline)

Suggested areas of co-operation with other research institutes:

- Ethanol as motor fuel
- Remote areas applications of photovoltaics

101. ENGINEERING INSTITUTE OF RESEARCH AND DEVELOPMENT (EIRD), SOLAR ENERGY RESEARCH GROUP

Faculty of Engineering
Chulalongkorn University
Bangkok 10500
Thailand

Telephone: 2525001-192

Director: Dr. Somsak Panyakeow

Contact person: Mr. Ekachai Leecarasme, Secretary

6 professional staff (4 PhD)

Government funded Annual budget 1984: US$ 10,000 - 20,000

Areas of research:

- Solar thermal power plant
- Solar drying
- Solar refrigerator
- Solar distillation
- Selective surface

Current projects:

Solar drying

Commercialized projects:

Solar collector for hot water supply

Joint research programmes carried out with:

- National Energy Administration (NEA)
- Electricity Generation Authority of Thailand (EGAT)

102. KING MONGKUT'S INSTITUTE OF TECHNOLOGY (KMITT)

Thonburi Campus
Rasburana
Bangkok 10140
Thailand

Telephone: 46 25 719

Director: Dr. Pibool Hungspreug, Vice-Rector

Contact person: Dr. Prida Wibulswas, Professor, Energy Technology Prog.

200 professional staff (30 PhD)

Government and private funded Annual budget 1984: US$ 3,500,000

Areas of research:

- Solar process heat (drying, distillation, flat plate and concentrating collectors, thermal power generation, thermal storage, refrigeration and air conditioning, radiation measurements and assessment, selective surfaces, solar simulator)
- Photovoltaic systems
- Bioenergy conversion (biogas, thermochemical conversion, bioproductivity)
- Wind technology (wind energy assessment, water pumping, electric power generation)

Current projects:

About 40 projects in above-mentioned areas

Commercialized projects:

- Flat plate collectors
- Natural convection type dryers

Suggested areas of co-operation with other research institutes:

The areas identified above

103. NATIONAL ENERGY ADMINISTRATION

Kasatsuk Bridge
Bangkok 10500
Thailand

Telephone: 2224102-10 Telex: 20524 NAPOWER TH Cable: NATPOWER

Director: Mr. Prapath Premmani, Secretary General

Contact person: Mr. Prapath Premmani

3 professional staff (1 PhD)

Funded by Government and USAID	Government contribution (per year):	US$ 528,600
	USAID (over 5 years):	US$ 5,000,000

Areas of research:

- Solar collector testing
- Solar pumping system
- Solar dryer
- Solar distillation
- Solar data analysis
- Feasibility study of solar hot water system application for industries, hospital and commercial service building

Current projects:

- Demonstration projects on solar photovoltaic pumping system for village irrigation and water supply
- Demonstration projects on solar hot water heating system for industrial application

Joint research programmes carried out with:

- Faculty of Engineering, Chulalongkorn University, Thailand
- Faculty of Engineering, King Mongkut's Institute of Technology, Thailand
- Meteorological Department, Thailand

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research'

104. PHYSICS DEPARTMENT, SOLAR ENERGY GROUP, PRINCE OF SONGKLA UNIVERSITY

P.O. Box 3, Kohong
Haad Yai
Thailand

Telephone: 24 48 77-267 Telex: 62168 PSU HI TH

Director: Dr. C. Silawatshananai, Assistant Professor

Contact person: Dr. C. Silawatshananai

1 professional staff (PhD)

Government funded Annual budget 1984: US$ 10,000

Areas of research:

- Utilization of small solar furnace
- Development of solar energy material by means of plasma sputtering

Current projects:

As above

Commercialized projects:

Solar drying of rubber sheet

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research'

105. **SEMICONDUCTOR DEVICE RESEARCH LABORATORY**

Faculty of Engineering
Chulalongkorn University
Bangkok 10500
Thailand

Telephone: 2525001-187

Director: Dr. Somsak Panyakeow

6 professional staff (4 PhD)

Government funded

Annual budget: US$ 30,000 - 40,000
1984

Areas of research:

- Photovoltaic cells
- Photovoltaic system and application

Current projects:

- Single crystalline silicon solar cells
- Polycrystalline solicon solar cells
- Photovoltaic system design and applications

Joint research programmes carried out with:

- National Energy Administration (NEA)
- Electricity Generation Authority of Thailand (EGAT)
- Military Research and Development Center
- Tokyo Institute of Technology

106. THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH

196 Phahonyothin Road
Bang Khen
Bangkok 10900
Thailand

Telephone: 57 91 121-30 Telex: TISTR BANGKOK

Director: Dr. Smith Kampempool

Contact person: Ms. Nara Pitakarnnop, Director, Energy Research Div.

304 professional staff (15)

Government and private funded with contributions of international agencies

Annual budget 1984: US$ 4,300,000

Areas of research:

- Renewable energy
- Industry
- Agriculture
- Building
- Environment

Current projects (in energy sector):

- Production of fuel alcohol from cassava
- Pyrolysis of rice husk
- Industrial implementation of a photovoltaic project (under negotiation)

Commercialized projects:

- Feasibility study on production of rice husk briquets
- Production of biogas from waste water

Joint research programmes carried out with:

- Japan Association of Industrial Fermentation (JAIF)
- National Energy Administration (NEA)
- International Development Research Centre (IDRC)

TRINIDAD AND TOBAGO

107. THE UNIVERSITY OF THE WEST INDIES (U.W.I.), SOLAR ENERGY PROJECT

Department of Chemistry
University of the West Indies
St. Augustine
Trinidad and Tobago

Telephone: Direct Line: 662-4524 Cable: STOMATA
P.B.X. 66 31364, 31374

Contact person: Dr. Oliver Headley, Senior Lecturer, Dept. of Chemistry

4 professional staff (PhD)

Funded by U.W.I., E.D.F., OAS Annual budget 1984: US$ 10,000

Areas of research:

- Solar crop drying
- Solar distillation for distilled water
- Solar collectors for alcohol fuel production

Current projects:

- Solar stills for schools (appr. 20 in Trinidad and Tobago and appr. 50 in Jaimaica
- Solar driers for rural farmers (Barbados 20 m^2 drier, Grenada 8m^2 drier, Guyana one 20 m^2 and a few 2.5 m^2 driers, Dominica 2m^2 driers)

Joint research programmes carried out with:

- University of McGill, Brace Research Institute, Canada
- Caribbean Agricultural Research and Development Institute (CARDI)
- Brace Research Institute, McDonald College,
  Ste Anne de Bellevue, Quebec H9X 1CO, Canada
- Grenada Agro Industrial Laboratory, Belmont, St. Georges, Grenada

TURKEY

108. KOC HOLDING S.A. - RESEARCH AND DEVELOPMENT CENTER

Sutluce Karaagac Cad 2/4
Halicioglu
Istanbul
Turkey

Telephone: 150 0890, 150 1427
150 1427, 150 0891
Telex: 24101 arcktr

Director: Mr. Jean Nahum

Contact person: Mr. Jan Klod Holat, Project Co-ordinator, Dept. Manager

24 professional staff
(5 in Energy Department)

Private funded

Annual budget 1984: US$ 600,000
(For energy projects US$ 100,000)

Areas of research (Only in Energy Department concerning solar energy):

- Feasibility studies for photovoltaic manufacturing plant
- Development of three flat plate solar collectors
- Technical and economic feasibility studies for wind generators

Current projects:

As above

Joint research programmes carried out with:

116 industrial and/or commercial companies belonging to the KOC Holding Group

UGANDA

109. MAKERERE UNIVERSITY

P.O. Box 7062
Kampala
Uganda

Telephone: 42471

Director: Prof. J.O. Ilukor, Head, Department of Physics

Contact person: Prof. J.O. Ilukor

14 professional staff (7 PhD)

Government funded Annual budget1984: US$ 70,000 - 100,000

Areas of research:

- Solar heating and cooling
- Solar crop drying
- Biogas and improved charcoal stoves

Current projects:

- Refrigeration
- Parabolic concentrators
- Biogas appliances

Commercialized projects:

Biogas and charcoal stoves

Joint research programmes carried out with:

Through Commonwealth Science Council (London) with: Kenya, Tanzania, Zambia, Malawi, Zimbabwe, Mauritius, Seychelles, Cyprus etc.

VENEZUELA

110. UNIVERSIDAD SIMON BOLIVAR, NUCLEO UNIVERSITARIO DEL LITORAL

Ap. Postal 314, La Guaira 1160-A
Departamento Vargas
Venezuela

Telephone: (031) 71111 to 115 Telex: 21910 USB-NUL

Director: Dr. Carlos Pittaluga Zerpa

Contact person: Dr. Eric R. Mayer, Solar Energy Research Co-ordinator

7 professional staff (1 PhD)

Government and contract funded Annual budget 1984: US$ 25,000

Areas of research:

- Solar active and passive cooling
- Energy conservation
- Biochmatic constructions
- Integrated energy systems
- Industrial process heat

Current projects:

- Development of a simplified model for comfort assessment in constructions
- Passive cooling, simulation and optimization of an industrial
- Process heat plant based on the maximization of the exergetical
- gain

Commercialized projects:

Use of solar cells to provide energy to service modules in a remote village of the Amazonas Territory

Joint research programmes carried out with:

- Dr. E. Hernandez - Faculty of Architecture - UNAM Mexico
- Dr. J. Vigneron - Department for Environment, Paris VII, France

Suggested areas of co-operation with other research institutes:

- Passive cooling
- Simulation of thermal processes
- Energy conservation

YUGOSLAVIA

111. INSTITUT "RUDJER BOSKOVIC" (IRB), MATERIALS RESEARCH AND ELECTRONICS DEPARTMENT

Bijenicka 54
41001 Zagreb
SR Croatia
Yugoslavia

Telephone: (041) 435-111 Telex: 21383 yu irb zg Cable: INSTRUBO

Directors: Dr. S. Kveder, Director General, Dr. B. Etlinger, Director, Materials Research and Electronics Department (MRE)

Contact person: Dr. Natko Urli, Scientific Adviser

54 professional staff (17 PhD)

Funded by Government (70%) and Industry (30%) Annual budget 1984: US$ 500,000

Areas of research:

- Solid state physics and chemistry
- Interaction of plasma with surfaces
- Electronics
- Solar energy
- Nuclear energy

Current projects:

- Ion implantation in semiconductors
- Electron beam annealing
- Thin film solar cells
- Solid-state electrolytes and batteries

Commercialized projects:

- Tables of solar irradiation on inclined surfaces in Yugoslavia
- Solar collectors and solar water heating systems
- Gas-sensor (explosive and poison gases) systems

Joint research programmes carried out with:

The institute co-ordinates solar energy research programme in Croatia and co-operates with eight institutions in the country located in Zagreb, Split and Rijeka

Suggested areas of co-operation with other research institutes:

Photovoltaic solar cells

ZAMBIA

112. PHYSICS DEPARTMENT, THE UNIVERSITY OF ZAMBIA

P.O. Box 32379
Lusaka
Zambia

Telephone: 213221-277
213681-277
Telex: UNZALU
ZA 44370
Cable: UNZA
LUSAKA

Director: Professor A.F. Fort, Head of Department

Contact person: Dr. P.K. Jain, Lecturer

18 professional staff (PhD)

Government funded

Annual budget 1984: US$ 500,000

Areas of research:

- Solid state physics - magnetics
- Nuclear physics - low energy
- Solar energy

Current projects:

- Magnetic separation of cobalt
- Study of solar radiation in Zambia

Suggested areas of co-operation with other research institutes:

- Magnetics
- Solar energy

ZIMBABWE

113. CIVIL ENGINEERING DEPARTMENT, UNIVERSITY OF ZIMBABWE

P.O.Box MP 167
Mount Pleasant
Harare
Zimbabwe

Telephone: 303211 Telex: 4-152 ZW

Head of Dept.: Prof. W.R. Mackechme

Contact person: Eng. J.C. Johnston, Senior Lecturer

10 professional staff (2 PhD)

Government funded

Areas of research:

Occasional research projects are done by students at present, but it is hoped to increase the scope of the work in the future.

Current projects:

- Improvement of an already built solar oven
- Production of further "Clear Day Radiation" data - a follow-up of M. Phil thesis by J.C. Johnston
- Specification for meteorology data bank for solar energy research

Suggested areas of co-operation with other research institutes:

Data bank, crop drying and water heating are the principal practical considerations at present.

114. INSTITUTE OF AGRICULTURAL ENGINEERING

P.O. Box BW 330, Borrowdalle
Harare
Zimbabwe

Telephone: 88 27 22, 88 31 19 Cable: IAE

Director: Mr. John Spear

Contact person: Mr. B. Byabura-Kirya, Research Engineer

10 professional staff

Government funded

Areas of research:

(a) Solar crop drying
(b) Solar water pumping
- Thermodynamic pumps
- Photovoltaics

(c) Wind energy for water pumping

Current projects:

- Solar steam pump (Vanek)
- Testing of photovoltaic pumps for deep borehole pumping

Commercialized projects:

Solar crop drying using roof collectors

Suggested areas of co-operation with other research institutes:

Solar water pumps (thermodynamic pumps)

115. ZIMBABWE UNIVERSITY TECHNOLOGY FORUM (UTF)

Dept. of Land Management
University of Zimbabwe
Box MP-167, Mt. Pleasant
Harare
Zimbabwe

Telephone: 303211-412 Telex: 4152 UNIVZ ZW

Director: Chairman, Dept, of Land Management

Contact person: Mr. W.J. Ascough, Senior Lecturer, Agric. Engineering

1 professional staff

Private funded Annual budget 1984: US$ 1,000

Areas of research:

- Technology transfer to low-income rural communities
- Low-cost solar energy applications for rural development, e.g. crop drying, cooking, water heating and biomass use

Current projects:

- Application of solar energy to a low-income isolated community in north-east Zimbabwe
- Introduction of solar energy into new secondary school science curriculum

Joint research programmes carried out with:

General solar energy promotion talks, lectures and information to schools, service organizations and co-operation with Solar Energy Society of Zimbabwe

Suggested areas of co-operation with other research institutes:

The limited resources of the institute and national needs dictate focusing on promotion and education more than research

ALPHABETICAL INDEX OF INSTITUTIONS

AGENCY FOR ASSESSMENT AND DEVELOPMENT OF TECHNOLOGY (ENERGY DEVELOPMENT AND APPLICATION PROJECT), Indonesia 043
AGRICULTURAL TOOLS RESEARCH CENTRE (ATRC), India 019
APPROPRIATE TECHNOLOGY DEVELOPMENT ASSOCIATION (ATDA), India 020
ASIAN INSTITUTE OF TECHNOLOGY (AIT), Thailand 097
BALAJU YANTRA SHALA SANITARY ENGINEERING LIMITED/BYSSEL, Nepal 065
BEIJING SOLAR ENERGY RESEARCH INSTITUTE (BSERI), China 073
BHARAT HEAVY ELECTRICALS LIMITED, CONTROL EQUIPMENT DIVISION, India 021
CARIBBEAN DEVELOPMENT BANK/TECHNOLOGY AND ENERGY UNIT (CDB/TEU), West Indies 007
CENTRAL ARID ZONE RESEARCH INSTITUTE, India 022
CENTRAL BUILDING RESEARCH INSTITUTE (CBRI), India 023
CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE (CECRI), India 024
CENTRAL ELECTRONICS ENGINEERING RESEARCH INSTITUTE (CEERI), India 025
CENTRAL INSTITUTE OF AGRICULTURAL ENGINEERING, India 026
CENTRAL SALT AND MARINE CHEMICALS RESEARCH INSTITUTE (CSMCRI), BHAVNAGAR, India 027
CENTRE DE DEVELOPPEMENT DES MATERIAUX - LABORATOIRE DES MATERIAUX SOLAIRES, Algeria 001
CENTRE DE RECHERCHE DES UTILISATIONS DES ENERGIES ALTERNATIVES (CRUEA), Burundi 010
CENTRE D'ETUDES BURUNDAIS EN ENERGIES ALTERNATIVES - CEBEA, Burundi 009
CENTRE FOR AGRICULTURAL MECHANIZATION AND RURAL TECHNOLOGY (CAMARTEC), Tanzania 093
CENTRE FOR ENERGY STUDIES, INDIAN INSTITUTE OF TECHNOLOGY, DELHI, India 028
CEYLON INSTITUTE OF SCIENTIFIC AND INDUSTRIAL RESEARCH, Sri Lanka 089
CIVIL ENGINEERING DEPARTMENT, UNIVERSITY OF ZIMBABWE, Zimbabwe 113
COMISION NACIONAL DE INVESTIGACIONES ESPACIALES (CNIE), DEPARTAMENTO DE ENERGIAS NO CONVENCIONALES, Argentina 004
DELEGATION UNIVERSITAIRE AUX ENERGIES NOUVELLES (D.U.E.N.), Madagascar 053
DEPARTMENT OF BUILDING SCIENCE, NATIONAL UNIVERSITY OF SINGAPORE, Singapore 086
DEPARTMENT OF MECHANICAL ENGINEERING, UNIVERSITY OF SCIENCE AND TECHNOLOGY, Ghana 016
DEPARTMENT OF MECHANICAL ENGINEERING, UNIVERSITY OF LAGOS, Nigeria 066
DEPARTMENT OF MECHANICAL ENGINEERING, UNIVERSITY OF NAIROBI, Kenya 051
DEPARTMENT OF MECHANICAL ENGINEERING, PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY, Papua New Guinea 072
DEPARTMENT OF PHYSICS, UNIVERSITI KEBANGSAAN MALAYSIA (UKM), Malaysia 059
DEPARTMENT OF PHYSICS, UNIVERSITY OF GHANA, LEGON, Ghana 017
DEPARTMENT OF SCIENCE SERVICE, PHYSICS AND ENGINEERING DIVISION, Thailand 098
DEPT. OF AGRICULTURAL ENGINEERING AND LAND PLANNING, UNIVERSITY MOROGORO, Tanzania 096

DESERT DEVELOPMENT CENTER, THE AMERICAN UNIVERSITY IN CAIRO, Egypt 013
ECOLE MOHAMMADIA D'INGENIEURS, Morocco 064
ECOLE NATIONALE SUPERIEURE POLYTECHNIQUE, Cameroon 011
ECOLE NATIONALE SUPERIEURE UNIVERSITAIRE DE TECHNOLOGIE (ENSUT), Senegal 083
ELECTRICITY GENERATING AUTHORITY OF THAILAND (EGAT), Thailand 099
ENERGY CONVERSION DEVELOPMENT CENTER (C.D.C.E.), Algeria 002
ENERGY INDUSTRY DEVELOPMENT OFFICE, Thailand 100
ENERGY RESOURCES DIVISION, RESEARCH INSTITUTE, UNIVERSITY OF PETROLEUM AND MINERALS, Saudi Arabia 082
ENERGY STUDIES UNIT (ESU), INSTITUTE FOR NATURAL RESOURCES, Fiji 015
ENGINEERING INSTITUTE OF RESEARCH AND DEVELOPMENT (EIRD), SOLAR ENERGY RESEARCH GROUP, Thailand 101
FACULTY OF ENGINEERING, MECHANICAL ENGINEERING DEPARTMENT, UNIVERSITY OF MALAYA, Malaysia 056
FACULTY OF ENGINEERING, NATIONAL UNIVERSITY OF SINGAPORE, Singapore 087
GENERAL ORGANIZATION OF ENGINEERING INDUSTRIES, Syria 090
GENERAL RESEARCH INSTITUTE FOR NON-FERROUS METALS (GRINM), China 074
GRUPO DE ENERGIA SOLAR - INSTITUTO DE FISICA ROSARIO (CONICET-UNR/GES-IFIR), Argentina 005
INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY, India 029
INDIAN INSTITUTE OF TECHNOLOGY (IIT), KHARAGPUR, India 030
INDUSTRIAL RESEARCH INSTITUTE, Ghana 018
INDUSTRIAL TESTING AND RESEARCH CENTER, Syria 091
INSTITUT DE RECHERCHE SUR LES ENERGIES NOUVELLES (IREN), Ivory Coast 048
INSTITUT PENYELIDEKAN & KEMASUAN PERTANIAN MALAYSIA, MALAYSIAN RESEARCH AND DEVELOPMENT INSTITUTE (MARDI), Malaysia 057
INSTITUT "RUDJER BOSKOVIC" (IRB), MATERIALS RESEARCH AND ELECTRONICS DEPARTMENT, Yugoslavia 111
INSTITUTE FOR GEOLOGICAL AND MINING RESEARCH (IRGM), ENERGY RESEARCH LABORATORY (LRE), Cameroon 012
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INSTITUTO DE FISICA - UNIVERSIDADE ESTADUAL DE CAMPINAS, GROUPO DE ENERGIA, Brazil 008
INSTITUTO DE INGENIERIA, UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO (UNAM), Mexico 062
INSTITUTO DE INVESTIGACIONES EN ENERGIA NO CONVENCIONAL (INENCO), Argentina 006
INSTITUTO TECNOLOGICO Y DE ESTUDIOS SUPERIORES DE MONTERREY/ITESM, Mexico 063
INTERDISCIPLINARY RESEARCH GROUP (IDRG), India 031
JAWAHARLAL NEHRU UNIVERSITY (JNU), UNIVERSITY INSTRUMENTATION CENTRE, India 032
JYOTI LIMITED, ENERGY DIVISION, India 033
KAPUR SOLAR FARMS, India 034
KENYA INDUSTRIAL RESEARCH AND DEVELOPMENT INSTITUTE, Kenya 052
KING MONGKUT'S INSTITUTE OF TECHNOLOGY (KMITT), Thailand 102
KOC HOLDING S.A. - RESEARCH AND DEVELOPMENT CENTER, Turkey 108
KOREA INSTITUTE OF ENERGY & RESOURCES (KIER), Republic of Korea 081
LABORATOIRE DE L'ENERGIE SOLAIRE (L.E.SO.), Mali 061

LEMBAGA FISIKA NASIONAL (LFN-LIPI) - NATIONAL INSTITUTE FOR PHYSICS, Indonesia 044
MAKERERE UNIVERSITY, Uganda 109
MECHANICAL AND INDUSTRIAL ENGINEERING DEPARTMENT, UNIVERSITY OF ROORKEE (MIED/UOR), India 035
MECHANICAL ENGINEERING DEPARTMENT, UNIVERSITY OF JORDAN, Jordan 049
MECHANICAL ENGINEERING DEPARTMENT, UNIVERSITY OF SHIRAZ, Iran 045
MINISTRY OF NATIONAL DEVELOPMENT, TECHNOLOGY FOR DEVELOPMENT DIVISION, Seychelles 085
NATIONAL ENERGY ADMINISTRATION, Thailand 103
NATIONAL INSTITUTE OF SILICON TECHNOLOGY, Pakistan 069
NIGERIAN INSTITUTE OF PLANT SCIENCE AND SOLAR ENERGY/TECHNOLOGY, Nigeria 067
PAKISTAN COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (PCSIR), Pakistan 070
PHILIPPINE NATIONAL OIL COMPANY - ENERGY RESEARCH AND DEVELOPMENT CENTER (PNOC-ERDC), Philippines 079
PHYSICS DEPARTMENT, NATIONAL UNIVERSITY OF SINGAPORE, Singapore 088
PHYSICS DEPARTMENT, SOLAR ENERGY GROUP, PRINCE OF SONGKLA UNIVERSITY, Thailand 104
PHYSICS DEPARTMENT, THE UNIVERSITY OF ZAMBIA, Zambia 112
POLYTECHNIC, Malawi 054
RESEARCH AND DEVELOPMENT CENTRE, HINDUSTAN BROWN BOVERY LTD., India 036
RESOURCES DEVELOPMENT INSTITUTE (RDI), India 037
ROYAL SCIENTIFIC SOCIETY (RSS), SOLAR ENERGY RESEARCH CENTER (SERC), Jordan 050
SCIENCE AND TECHNOLOGY UNIT (SIT/WRD), UNITED NATIONS ECONOMIC COMMISSION FOR AFRICA (UNECA), Ethiopia 014
SCIENTIFIC STUDIES AND RESEARCH CENTER (SSRC), Syria 092
SEMICONDUCTOR DEVICE RESEARCH LABORATORY, Thailand 105
SHANGHAI INSTITUTE OF ENERGY, China 075
SHANGHAI NON-FERROUS METALS RESEARCH INSTITUTE, China 076
SOCIETE INDUSTRIELLE DES APPLICATIONS DE L'ENERGIE SOLAIRE (SINAES), Senegal 084
SOLAR ENERGY CENTER, Iran 046
SOLAR ENERGY GROUP, DEPARTMENT OF MECHANICAL ENGINEERING, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA, India 038
SOLAR ENERGY RESEARCH CENTRE, Iraq 047
SOLAR ENERGY RESEARCH SECTION, SHANGHAI INSTITUTE OF MECHANICAL ENGINEERING, China 077
STATION D'EXPERIMENTATION DES EQUIPEMENTS SOLAIRES, Algeria 003
STANDARDS AND INDUSTRIAL RESEARCH INSTITUTE OF MALAYSIA (SIRIM), Malaysia 058
TANZANIA NATIONAL SCIENTIFIC RESEARCH COUNCIL (UTAFITI), Tanzania 095
TATA ENERGY DOCUMENTATION AND INFORMATION CENTRE, India 040
TATA ENERGY RESEARCH INSTITUTE, FIELD UNIT (TERI/FRU), India 041
TATA INSTITUTE OF FUNDAMENTAL RESEARCH (TIFR), India 042
THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH, Thailand 106
THE INTERNATIONAL RICE RESEARCH INSTITUTE (IRRI), Philippines 080
THE NATIONAL INDUSTRIAL DEVELOPMENT CORPORATION LIMITED (NIDC), India 039
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THERMAL AND PASSIVE ENERGY LABORATORY, UNIVERSITY OF IFE, Nigeria 068
UNIVERSIDAD SIMON BOLIVAR, NUCLEO UNIVERSITARIO DEL LITORAL, Venezuela 110
UNIVERSITI SAINS MALAYSIA, Malaysia 060
UNIVERSITY OF ENGINEERING AND TECHNOLOGY, PESHAWAR, Pakistan 071
UNIVERSITY OF MALAWI, THE POLYTECHNIC, Malawi 055
ZHEJIANG RESEARCH INSTITUTE FOR BIOGAS AND SOLAR ENERGY (ZIBS), China 078
ZIMBABWE UNIVERSITY TECHNOLOGY FORUM (UTF), Zimbabwe 115

ANNEX I

PLEASE COMPLETE AND RETURN TO: TECHNOLOGY PROGRAMME OF UNIDO, P.O.BOX 300, A-1400 VIENNA

DIRECTORY OF SOLAR RESEARCH INSTITUTES IN DEVELOPING COUNTRIES

INFORMATION SHEET

1. Name of Institute / Acronym:	
2. Address in full:	
3. Telephone:	Telex: Cable:
4. Name of director/head of institute:	Contact person: Name: Position:
5. Number of professional staff: (Number of PhD):	
6. Approximate annual budget (in US$):	Source of funding: Government Private
7. Areas of research:	
8. Current projects: Research projects already applied in industry (indicate No. and type):	
9. Is your institute engaged in joint research programmes with other institutions, either in your country or abroad? If so, please give names and addresses of these institutions.	
10. If not, would your institute be prepared to enter into joint research programmes with institutions in other developing countries: In which particular area would you wish to co-operate:	